Amman Price Index Volatility Shocks: Empirical Study during (2011 – 2015)

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ABSTRACT

This paper investigates the Amman Price Index volatility shocks and assesses whether these shocks are internal or external ones. Monthly time series data is collected over the period from January 2011 to December 2015 and the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) methodology is implemented to detect the sources of shocks in Amman Stock Exchange. Empirically, we find that the current volatility of Amman Price Index is due to internal shocks, while the external volatilities, such as FSTE and S&P 500, have not influenced the index significantly. These results conclude that Jordan Securities Commission has clearly captured the effect of external shocks, but definitely not that of internal ones. These particular vulnerabilities in the index indicate that the stock market in Jordan does not have large exposure to international trade. This suggests the presence of diversification opportunities for international investors in Amman Stock Exchange.

Keywords: ASE, GARCH, Shocks, DFM, FSTE, S&P500.

INTRODUCTION

As a result of the global financial crisis that firstly hit the US economy in late 2007 and then moved to the advanced countries, economic slowdown, due to the economic crisis around the world, including emerging markets. Cash crisis overcome not only developed markets but also developing markets, but was moving. The crises of the past few decades were characterized as a period of not only financial stability, but also relative macroeconomic stability, especially in the United States and major European countries. A major financial crisis in the United States and major advanced countries is a novelty for decision makers, other parts of the world regularly hit by the financial crisis. (Khan et al., 2014).

Several literatures provide evidence of linkages and contagion effects on different countries and their respective financial exchanges and monetary policy (macroeconomic variables, macroeconomic news announcements), such as (Hussain, 2010; Gay, 2008). Some literatures investigated the volatility between stock exchanges employs cointegration, regression models (Antwi et al., 2013; Khan et al., 2014). Other literatures investigated the volatility between stock exchanges employs GARCH models (Hussain, 2010). Further literature reports an increasing amount of evidence on the predictability in volatility across various financial assets and markets. In a world of market uncertainties, the study of cluster volatility is of crucial prominence to the research topic of global risk. (Budd, 2014).

Several literatures investigate the relationship and the volatility between monetary policy instruments, fiscal policy instruments, macroeconomic variables and stock exchange returns or the impact monetary policy instruments, fiscal policy instruments macroeconomic variables on the performance of recent post crashed stock exchange (Antwi et al., 2013; Khan et al., 2014; Hussain, 2010). Each research used different macroeconomic

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variables such as interest rates, inflation, exchange rate, and money supply.

For a developing economy such as Jordan, the Amman Stock Exchange (ASE) is large in terms of market capitalization (almost 59 percent of GDP)[1]. The ASE plays a significant role in directing and intermediating capital in the Jordanian economy, which historically depends to a significant extent on foreign capital inflows due to limited local resources. It is thus important to understand what factors affect the performance of the ASE, the sources of these effects, and if they are internal or external. Uncovering the sources of shocks which affect the market is important for the regulator and individual investor as well. It is also important from a macroeconomic prospective since a big adjustment in the stock market affects wealth, consumption, and probably capital flows.

In consequence, this study raises several questions; if the Industrial Production General Index IPGI (as a measurement of economic activity) has any impact on Amman Price Index? If Amman Price Index (API) volatility is influenced by its' own ARCH and GARCH factors or own shocks? Does Amman Price Index (API) volatility is influenced by the volatility of foreign markets such as DFM, FSTE and S&P 500. One would expect that the answers to these questions will provide a greater insight and assistance into future global portfolio risk management, policymakers, and financial analysts alike in Securities Exchanges Commission in particular and public authorities in general.

Our paper makes several major contributions to the literature. First, this is, to our knowledge, one of the few studies that assesses the sources of Amman Price Index (API) volatility shocks. Our second key contribution is that we design a model which captures Amman Price Index volatility using advanced econometrics methods. As our third contribution we employ the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) methodology to investigate own-volatility and outside volatility.

The rest of the paper is organized as follows; section two summarizes the main previous studies which investigates the stock market index volatility shocks. Section three describes the methodology and the data used. The result and analysis are presented in section four. Finally, the conclusion is outlined in section five.

1. Literature Review

Although the assumption in the financial press indicated that the stock market index volatility shocks are influenced by their own factors or by the volatility of macroeconomic factors (outside shocks), empirical evidence regarding the impact of main factors, own shocks, or outside shocks on volatility of stock returns have been mixed.

Investigating the impact of monetary policy in stock returns in Europe and US, Hussain (2010) showed that monetary policy decisions generally exert an immediate and significant influence on stock index returns and volatilities in both European and US Exchanges. The findings also indicate that European Central Bank's (ECB) press conferences following monetary policy decisions on the same day have define impacts on European index return volatilities, implying that they convey important information to market participants. Overall, the analysis suggests that the use of high frequency data is critical for separating the effects of monetary policy actions from those of macroeconomic news announcements on stock index returns and volatilities. From their side, Liljeblom and Stenius (1997) suggested that stock exchange volatility is a predictor for macroeconomic volatility, as well as the converse. Tests of the explanatory power of the macroeconomic

[1] We calculated it manually using the 2017 data from Central Bank of Jordan.

volatilities indicate that big part of the changes in aggregate stock volatility might be related to macroeconomic volatility. Some evidence of a negative relationship between stock exchange volatility and trading volume growth was also detected.

Highlighting the USA and European Exchanges further, Corradi et al., (2010) illustrated that the level of stock exchange volatility cannot be merely explained by business cycle factors. Rather, it relates to the presence of some unobserved factor. At the same time, their model predicts that such an unobservable factor cannot explain the ups and downs stock volatility experiences over time of volatility. Instead, the volatility of stocks relates to the business cycle. Furthermore, Rigobon and Sack (2002) showed that the response of asset prices to changes in monetary policy can be identified based on the increase in the variance of policy shocks that occurs on days of FOMC meetings and of the Chairman's semi-annual monetary policy testimony to Congress. Moreover, Chatziantoniou et al., (2013) results show that both fiscal and monetary policies influence the stock exchange, via either direct or indirect channels. More importantly, the results indicated that the interaction between the two policies is very important in explaining stock exchange developments. Thus, investors and analysts in their effort to understand the relationship between macroeconomic policies and stock market performance should consider fiscal and monetary in cycle rather than in isolation. From their side, Bjørnland and Leitemo (2005) found great interdependence between interest rate setting and stock prices; a major part of the surge in stock prices at the end of the 1990s is attributed to these non-fundamental shocks.

To discuss this further, D’Amico and Farka (2002) illustrated that monetary policy responds in a positive fashion to contemporaneous changes in the stock exchange, but this relationship is not significant. In addition, the results show that stock returns respond negatively to a positive monetary policy shock and that this response is significant at 1% level. Gali and Gambetti (2015) pointed to protracted episodes in which, after a short-run decline, stock prices increase persistently in response to an exogenous tightening of monetary policy. Those responses are clearly odd with the "conventional" view on the effects of monetary policy on bubbles, as well as with the predictions of bubble less models. On the other hand, Ozdagli and Yu (2012) do not support the hypothesis that stock prices of financially constrained firms are more responsive to monetary policy shocks, which seems to contradict the financial accelerator theory presented in Bernanke, Gertler, and Gilchrist (1999) but is consistent with Lamont, Polk, and Sa´a-Requejo (2001) who find that the relative stock exchange performance of constrained firms does not reflect monetary policy or credit conditions. Furthermore, Bredin and Reilly (2005) have conducted a study on the UK Exchange; the variance decomposition results indicate that the monetary policy shock leads to a persistent negative response in terms of future excess returns for a number of sectors. From their side, Akhtaruzzaman and Barua (2006) showed that the estimated coefficients of money supply and money demand equations from the structural VAR model are theoretically consistent, suggesting that the short run identification restrictions are valid. Finally, Caldara et al. (2016) indicated that financial shocks have a significant adverse effect on economic outcomes and those shocks were an especially important source of cyclical fluctuations since the mid-1980.

Moving to discuss the effect of volatility on stock market index in the Middle East and Asia, Albaity (2011) found that in the variance univariate models of the conventional indices, the M1, M3, inflation rate, and real growth in GDP are significant in influencing the Islamic Stock Exchange Index volatility in Malaysia, while M2, M3, inflation rate and interest rate affected Islamic Stock Exchange Index in the US volatility. Al Rjoub (2009) studied the Exchange in Jordan and measured the impact of the financial crisis on stock exchange returns and volatility; the results illustrated that volatility behavior during crises behaves in different manners in the Amman stock exchange. However, imported crises caused volatility to decrease or increase based on the general public expectations; if expectations are pessimistic, the effect will be resembled by dampen demand for investment causing volatility to decrease and the size of trading to decrease. On the other hand, if expectations are optimistic volatility will increase derived by the increased size of investment. The results indicated that local stock exchange crash during 2005 and the global financial crises of 2008 showed no impact on volatility with insignificant coefficients. Furthermore, Chen (2014) showed that the price fluctuation of each exchange has an influence on other exchanges, although the price behavior is significantly independent. From his side, Purnomo (2013) investigated the Exchange of Indonesia. He found evidence that the Jakarta Composite Stock Market Index is cointegrated with several domestic macroeconomic variables. In addition, he found that the Indonesian-dollar exchange rate has bidirectional influences on the Jakarta Composite Index. In addition to domestic macroeconomic variables, he reported evidence that the Composite Index is cointegrated with the stock exchange indexes of several Southeast Asian stock exchanges.

Turning to Africa, Oluseyi (2015) studied the Exchange of Nigeria and used monthly data for a period of January 1990 – December 2014. The results showed that the volatility in GDP, inflation and money supply were not found to Granger-cause and not significantly related to stock exchange prices volatility. However, only volatility in interest rate and exchange rate does Granger-cause stock market prices volatility; while from the regression analysis side, only interest rate volatility and exchange rate are significantly linked with stock exchange prices volatility. This finding is permissible in the case of developing countries with the rule of non-institutional investors and the existence of information asymmetry problem among investors which could account for the weak relationship between stock market prices volatility and macroeconomic variables' volatility. From his side, Yonis (2011) compared between US and South African stock exchanges; he found evidence of return spillover from NYSE to JSE by analyzing VAR based on two lags. While analyzing the MA-GARCH model, empirical results exhibit that volatility spillover between US and SA is perseverance.

In light of the previous literature, this paper fills important gaps and makes several contributions to the literature. In particular, it assesses the sources of Amman Market Index volatility shocks if they are from its own or previous shocks on the one hand, or if they are out board shocks on the other. In the previously literature, there has been a several empirical studies that investigated the volatility spillover effects on Amman Price Index, nevertheless, these studies have focused almost exclusively on the effect of individual shocks or from individual sources; either internal or external. On other hand, our study determines at once whether the effects on API are own shocks, or outside shocks. Furthermore, we design a model which captures the API volatility and apply the new advanced GARCH methodology to investigate own-volatility and outside volatility.

3. Methodology

3.1 Data Selection and Data Collection

In our data base, our aim was to construct data for volatility of Amman Price Index (API), FSTE Index, Dubai Financial Market DFM, and S&P 500 as measurement of external volatilities. We also obtained data on Industrial Production General Index (IPGI)[2] as a measurement of economic activity. A monthly time series

[2] The sources of our data are Amman Stock Exchange Website, London Stock Exchange Website, Dubai Stock Exchange Website, Central Bank of Jordan and Investing.com website.

data was collected from January 2011 to December 2015. After assessing the availability and quality of data and most important periods for which the data were available, we ended up with 60 observations for each of the variables of the model.

3.2 Monthly Return

The monthly return is the function of the price of the index in the current month and the price of the Index in the previous month and can be represented in the following equation:

$R_{ti} = (P_{ti}–P_{ti-1})/P_{ti-1}$…………………………(1)

Where

R_{ti} Return of the Index for the current month

P_{ti} Price of the Index for the current month

P_{ti-1} Price of the Index for the previous month

3.3 Unit Root Test

Before conducting estimation and in order to avoid possible spurious regression, it is necessary to distinguish stationary from non-stationary variables. The first step undertaken would be to establish the order of integration of variables used in the model. This is accomplished by applying firstly the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests on each of the series in the estimated equations, standard unit root tests. The well-known ADF test for a unit root in y_t, omitting a linear deterministic trend is:

$\Delta y_t = \alpha + \beta y_{t-1} + \sum \delta_i \Delta y_{t-1} + \varepsilon_t$…………(2)

Where Δ is the difference operator, ε_t is a white noise disturbance term with variance σ^2, and t= 1, …, T indexes time. The Δy_{t-i} terms on the right-hand side of equation allow for serial correlation and are designed to ensure thatε_t is white noise. The empirical evidence suggests that there is no time trend in the data. The ADF (parametric test) test and PP (nonparametric test) has a null hypothesis of non-stationarity (random series) against an alternative of stationarity (nonrandom series).

3.4 ARCH and GARCH

Time series data usually exhibit three main characteristics. First, they exhibit volatility clustering or volatility pooling. In other words, periods of high volatility will be followed by periods of high volatility and the same applies for periods of low volatility. Second, their distribution is leptokurtosis, which mean that the distribution fat tailed. Third characteristic is the leverage effect. The leverage effect is the fact that bad news affects returns more than good news. In other words, changes in the prices tend to be negatively correlated with changes in volatility. Therefore, modeling such series needs to be extended using other models. The first two characteristics have been successfully modeled using ARCH (Autoregressive Conditional Heteroskedasticity) by Engle (1982) and GARCH (Generalized Autoregressive Conditional Heteroskedasticity) developed by Bollerslev (1986). The idea of ARCH and GARCH is to model the variance of the error term from the mean equation on the previous squared error terms. If the mean equation is as follow:

$Y_t = \alpha_i + \theta_i Y_{t-1} + \beta_i X_{t-1} + \varepsilon_t$…………………(3)

Where Y_t is the dependent variable, X_t is the independent variable, and ε_t is the error term and α_i, θ_i and $\beta_i$are the coefficients. The error term ε_t~N (0, δ^2) is assumed to have zero mean and a constant variance or homoscedasticity. However, it is unlikely in the financial time series that the variance of the error term be Homoskedastic. Ignoring the fact that the variance of the error term is Heteroskedastic will result in either over/under estimation of the standard error and therefore bias inferences. To overcome this problem ARCH model is used. The arch model is as follow:

$\sigma_t^2 = \omega + \sum_{i=1}^{p} \partial_i \varepsilon_{t-1}^2$……………………………(4)

Where σ_t^2 is the conditional variance, ε_{t-1}^2 is the lagged term of the squared error term from the mean equation, and ω and ∂_i are the coefficients. This model indicates that the variance of the error term is dependent on the lagged squared error term. Such model is referred to as ARCH (q) where (q) indicate the lag order of the squared error term in the variance equation.

Although ARCH model is capable of eliminating the heteroskedasticity in the mean equation, it still has some drawbacks that led to the development of GARCH model. GARCH model was developed by Bollerslev (1986) who indicated that a GARCH model with smaller number of terms can perform as well as or even better than ARCH model with many lags. The idea of the GARCH model is simply to include the lagged value of the variance in the variance equation. The GARCH model is as follow:

$$\sigma_t^2=\omega+\sum_{i=1}^{q}\partial_i\varepsilon_{t-i}^2+\sum_{j=1}^{p}\gamma_j\ \sigma_{t-j}^2+\sum_{v=1}^{l}\emptyset_v\ X_{t-v}\ldots.(5)$$

The first term in the right hand side is the ARCH term explained earlier, while the second term is the lagged variance that is GARCH. This model is referred to as GARCH (p,q) where (q) is the lagged ARCH term and (p) is the GARCH lagged term. The above model indicates that ω is the long-term average variance, ∂_i is the coefficient of the information about the volatility in the previous period, and γ_j is the coefficient of the lagged conditional variance.

Although GARCH model is better than ARCH specification since it is more parsimonious and less likely to breach the non-negative constraint it is still does not account for the leverage effect in the apparent in financial time series and does not allow for any direct feedback between the conditional variance and the conditional mean.

3.5 Regressors in the Variance Equation

Equation no. 6 may be extended to allow for the inclusion of exogenous or predetermined regressors, z , in the variance equation:

$$\sigma_t^2=\omega+\sum_{j=1}^{q}\beta_j\sigma_{t-j}^2+\sum_{i=1}^{p}\alpha_i\epsilon_{t-i}^2+Z_t'\pi\ldots\ldots\ldots(6)$$

Note that the forecasted variances from this model are not guaranteed to be positive. You may wish to introduce regressors in a form where they are always positive to minimize the possibility that a single, large negative value generates a negative forecasted value.

Distributional Assumptions

To complete the basic ARCH specification, we require an assumption about the conditional distribution of the error term ε. There are three assumptions commonly employed when working with ARCH models: Normal Gaussian Distribution, Student's t-d9istribution, and the Generalized Error Distribution (GED). Given a distributional assumption, ARCH models are typically estimated by the method of maximum likelihood.

For example, for the GARCH (1, 1) model with conditionally normal errors, the contribution to the log-likelihood for observation t is:

$$l_t=-\frac{1}{2}\log(2\pi)-\frac{1}{2}\log\sigma_t^2-\frac{1}{2}(y_t-X_t'\theta)^2/\sigma_t^2\ldots..(7)$$

Where σ_t^2 is specified in one of the forms above.

For the Student's t-distribution, the log-likelihood contributions are of the form:

$$l_t=-\frac{1}{2}\log\left(\frac{\pi(v-2)\Gamma\left(\frac{v}{2}\right)^2}{\Gamma\left(\frac{(v+1)}{2}\right)^2}\right)-\frac{1}{2}\log\sigma_t^2-\frac{(v+1)}{2}\log\left(1+\frac{(y_t-X_t'\theta)^2}{\sigma_t^2(v-2)}\right)\ldots\ldots..(8)$$

where the degree of freedom v > 2 controls the tail behavior. The t-distribution approaches the normal as $v\ \rightarrow\ \alpha$.

For the GED, we have:

$$l_t=-\frac{1}{2}\log\left(\frac{\Gamma\left(\frac{1}{r}\right)^3}{\Gamma\left(\frac{3}{r}\right)\left(\frac{r}{2}\right)^2}\right)-\frac{1}{2}\log\sigma_t^2-\left(\frac{\Gamma\left(\frac{3}{r}\right)(y_t-X_t\theta)^2}{\sigma_t^2\Gamma\left(\frac{1}{r}\right)}\right)^{r/2}\ldots\ldots\ldots(9)$$

where the tail parameter r > 0. The GED is a normal distribution if r = 2, and fat-tailed if r < 2.

By default, ARCH models in E Views are estimated by the method of maximum likelihood under the assumption that the errors are conditionally normally distributed.

4. Results

This section provides the detailed results of this study; the first part shows the unit root test results, while the second part provides the discussion of GARCH(1.1), Mean and Variance Equations. In part three, we discuss the decision of the model selection. Finally, in the fourth part we evaluate the models under three distributions.

4.1 Unit Root Results

This study uses the Augmented Dickey-Fuller (ADF) statistics (parametric test). The null hypothesis: there is a unit root in the index return. If the null hypothesis is rejected, it means that the time series is stationary (not random).

The results in Table No. 1 show that the null hypothesis of the unit root has been rejected under the Augmented Dickey-Fuller test at 1 percent, 5 percent and 10 percent significance level with intercept for the API, IPGI, DFM, FSTE and S&P500. This indicates that the series are stationary (not random) at the levels I(0) at 1% significance level.

Table No. 1: Unit Root Tests (Augmented Dickey-Fuller)
to check whether the series in the group (or the first or second differences of the series) are stationary

	With Intercept	
Variables	t statistics	P value
Amman Price Index API	-8.5506***	0.0000
Industrial Production General Index	-8.9666***	0.0000
Dubai Financial Market Index	-8.0273***	0.0000
FSTE	-9.6040***	0.0000
S&P00	-8.8214***	0.0000

*Significance at 10%, * *Significance at 5% and ** *Significance at 1%

4.2 Discussion of GARCH (1,1) Model, Mean Equation and Variance Equation

4.2.1. Mean Equation

$$API = C_1 + C_2\text{IPGI} + \varepsilon \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(10)$$

Here

API = Amman Price Index, C_1 = Constant, IPGI= Industrial Production General Index, e = Residuals, Here we have taken monthly data of 60 months.

Table No. 2 OLS Regression
is one of the most versatile and widely used statistical technique to specify and estimate a regression model, performing simple diagnostic analysis, and using your estimation results in further analysis

Dependent Variable: Amman Price Index (API)			
Coefficients	Beta	t value	P value
C_1(Constant)	-0.0033	-0.7990	0.4275
C_2 (IPGI)	0.0004	0.0039	0.9969
R Square	0.0000		
Adjusted R Square	-0.0172		
Durbin-Watson	2.2225		
F	0.00002		
P value	0.9969		

*Significance at 10%, * *Significance at 5% and ** *Significance at 1%

The results in Table 2 indicated that the adjusted R2 is -1.72% which means that the independent variable does not explain anything of the variations in the API. This means that this macro variable Industrial Production General Index which is one of Ross and Roll Arbitrage Pricing Theory Model explains nothing of the variation in Amman Price Index and there are other variables at the micro and macro level which explain the dependent variable.

Moreover, we cannot reject the null hypothesis which indicates that there is no significant effect of the IPGI on the API because the P-value is more than 10% (1-confidence level (90%)). This means that IPGI insignificantly affects the API.

The residual derived from mean equation can be plotted as in the below figure:

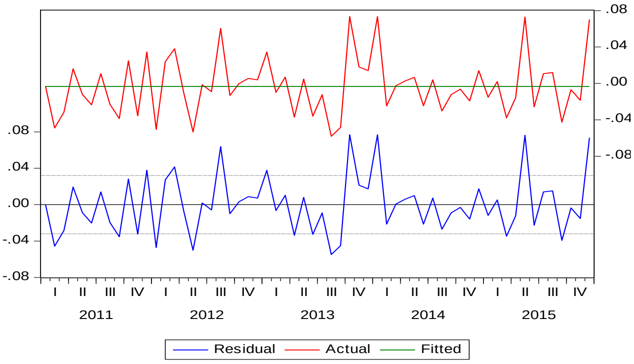

Figure 1 Residuals of API of 60 months

As shown in Figure 1, there is prolonged period of low volatility from month 1 to month 60,but the prolonged period of high volatility (there is some high volatility for small periods of time) is not exist.In other words, periods of low volatility are followed of low volatility. This suggests that residuals or error term is conditionally heteroscedastic and it can be represented by ARCH and GARCH model.

4.2.2 Variance Equation

Normal Gaussian Distribution

$H_t = C_3 + C_4H_{t-1} + C_5\varepsilon_{t-1}^2 + C_6\,DFM + C_7FTSE + C_8S\&P500$….(11)

Residuals derived from mean equation is used in making variance equation.

Table No.3 - Normal Gaussian Distribution see section 3.5 in methodology			
Coefficients	Beta	Z value	P-value
C_1(Constant)	-0.0067	-1.5977	0.1101
C_2 (IPGI)	0.0899	1.0631	0.2877
Variance Equation Model			
Dependent Variable: H_t			
C_3	0.0004	2.4262	0.0153
C_5 (RESID(-1)^2)	-0.2265	-2.1467**	0.0318
C_4(GARCH(-1))	0.6874	4.9440***	0.0000
C_6 (DFM)	0.0041	1.7651*	0.0776
C_7 (FSTE)	-0.0176	-2.1644**	0.0304
C_8 (S&P500)	0.0153	1.5825	0.1135
R Square	-0.0216		
Adjusted R Square	-0.0392		
Durbin-Watson	2.1831		
*Significance at 10%, * *Significance at 5% and ** *Significance at 1%			

Table No. 3 shows that under this distribution GARCH (H_{t-1}) or $C_4$is significant at 1% as the P value is 0.0000, it mean that previous day's residual volatility of API(H_{t-1}) can influence today 's volatility of API (H_t).

Moreover, Table 3 shows that ARCH (ε_{t-1}^2) or $C_5$is significant at 5% as the P value is 3.18%. This means that previous day 's API information about volatility can influence today's volatility of API (H_t).

These results indicate clearly that Amman Price Index (API) volatility is influenced by its own ARCH and GARCH factors or own shocks.

Furthermore, DFM Dubai Financial Market Index or C_6 is significant at 10% as the P value is 7.76%,is significant meaning that DFM Return may transmit to API.

Moreover, FSTE London Stock Exchange Index or $C_7$is significant at 5% as the P value is 3.04%, meaning that FSTE Return volatility or outside shocks can influence the volatility of API.

Finally, S&P500 USA Stock Exchange Index is not significant which indicates that S&P500 Index Return can't transmit to Amman Price Index API.

Student's t with fixed df

$H_t = C_3 + C_4 H_{t-1} + C_5 \varepsilon_{t-1}^2 + C_6\, DFM + C_7 FTSE + C_8 S\&P500$…(12)

Residuals derived from mean equation is used in making variance equation

Table No. 4 – Student's with fixed df see section 3.5 in methodology			
Coefficients	Beta	Z value	Pvalue
C_1(Constant)	-0.0021	-0.684934	0.4934
C_2 (IPGI)	-0.0765	-1.574398	0.1154
Variance Equation Model			
Dependent Variable: H_t			
C_3	0.0002	2.2170	0.0266
C_5 (RESID(-1)^2)	-0.2631	-3.0622***	0.0022
C_4 (GARCH(-1))	0.9936	24.5132***	0.0000
C_6 (DFM)	0.0029	2.46013**	0.0139
C_7 (FSTE)	-0.0108	-1.4832	0.1380
C_8 (S&P500)	0.0088	2.0269**	0.0427
R Square	-0.0095		
Adjusted R Square	-0.0269		
Durbin-Watson	2.2491		
*Significance at 10%, * *Significance at 5% and ** *Significance at 1%			

The results in Table 4 indicate that GARCH (H_{t-1}) or $C_4$is significant at 1% as the P value is 0.0000, it mean that previous day's residual volatility of API (H_{t-1}) can influence today 's volatility of API (H_t). In addition, the results show that ARCH(ε_{t-1}^2)or $C_5$is significant at 1% as the P value is 0.22%, indicating that previous day's API information about volatility (ARCH) can influence today's volatility of API (that is H_t). These results demonstrate that API volatility is influenced by its own ARCH and GARCH factors or own shocks.

Furthermore, DFM Dubai Financial Market Index or C_6 is significant at 5% as the P value is 1.39%,is significant meaning that DFM Return may transmit to API.

In addition, FSTE London Stock Exchange Index or C_7 is not significant meaning that FSTE Index Return can't convey effect to API. Finally, S&P 500 is significant at 5% as the P value is 4.27%, meaning that S&P 500 Return volatility or outside shocks can influence the volatility of API.

It means that we have received the same result when the distribution was Normal Gaussian, the only difference here is that S&P 500 who influence not the FSTE.

Generalized Error Distribution GED with fixed parameters

$H_t = C_3 + C_4 H_{t-1} + C_5 \varepsilon_{t-1}^2 + C_6\, DFM + C_7 FTSE + C_8 S\&P500$….(13)

Residuals derived from mean equation is used in making variance equation

Table No. 5 – GED with fixed parameters see section 3.5 in methodology			
Coefficients	Beta	Z value	P value
C_1(Constant)	-0.0073	-2.1412	0.0323
C_2 (IPGI)	-0.0570	-0.5417	0.5880
Variance Equation Model			
Dependent Variable: H_t			
C_3	0.0002	1.7296	0.0837
C_5 (RESID(-1)^2)	-0.2232	-2.8259***	0.0047
C_4 (GARCH(-1))	0.9986	19.4529***	0.0000
C_6 (DFM)	0.0024	1.70422*	0.0883
C_7 (FSTE)	-0.0050	-0.6210	0.5346
C_8 (S&P500)	0.0037	0.4096	0.6821
R Square	-0.0219		
Adjusted R Square	-0.0395		
Durbin-Watson	2.2053		
*Significance at 10%, * *Significance at 5% and ** *Significance at 1%			

Table no. 5 shows GARCH (H_{t-1}) or $C_4$is significant at 1% as the P value is 0.0000, indicating that previous day's residual volatility of API (H_{t-1}) can influence today's volatility of API (H_t). It is also shown that ARCH (ε_{t-1}^2) or $C_5$is significant at 1% as the P value is 0.47%, meaning that previous day 's API information on volatility (ARCH) can influence today 's volatility of API (H_t).These results illustrate that API volatility is influenced by its own ARCH and GARCH factors or own shocks.

Furthermore, DFM Dubai Financial Market Index or C_6 is significant at 10% as the P value is 8.83%, is significant meaning that Dubai Stock Exchange Index Return may transmit to API.

In addition, FSTE London Stock Exchange Index or C_7 is not significant indicating that FSTE Index Return does not impact API. Finally, S&P 500 or C_8 is not significant indicating that S&P 500 Return can't transmit to API.

It is worthy to mention that we have received almost the same result when the distribution was Normal Gaussian and Student's t, the only difference here is that neither S&P 500 nor FSTE influence the volatility of API.

4.2.3. Decision of the model

So we can conclude that the volatility of in API is largely dependent on its own shocks such as ARCH and GARCH and influenced by Arab Exchanges such as DFM, but volatility of FSTE and S&P 500 can't contribute in the volatility of API in all distributions.

4.2.4. Evaluation of models under three distributions

We need to select the most appropriate model to be implemented in this study. Doing so will suggest suitable hypotheses to be fulfilled.

Testing Hypothesis No. 1

Table 6 shows that we cannot reject the null hypothesis which indicates that there is no serial correlation in the residual or error term as the probability is more than 10% (1-confidence level (90%)). This means that the first hypothesis has been fulfilled for the three distributions.

Table No. 6 Serial Correlation in the Residual to find in time series regressions if the residuals are correlated with their own lagged values.					
Normal Gaussian		Student's t with fixed df		GED with fixed parameters	
Q-Stat	Prob*	Q-Stat	Prob*	Q-Stat	Prob*
0.2201	0.6390	0.0468	0.8290	0.1571	0.6920
0.2348	0.8890	0.0643	0.9680	0.1572	0.9240
1.1299	0.7700	2.9457	0.4000	2.8952	0.4080
1.1299	0.8900	3.0161	0.5550	3.0247	0.5540
1.4271	0.9210	3.0491	0.6920	3.4159	0.6360
3.1683	0.7870	5.1219	0.5280	6.0753	0.4150

Testing Hypothesis, No. 2

Table 7 below shows that we cannot reject the null hypothesis which indicates that there is no ARCH effect as the Probability Chi- Square (1) is more than 10% (1-confidence level (90%)). Accordingly, the second hypothesis has been fulfilled for the three distributions.

Table No. 7 Heteroskedasticity Test: ARCH carries out Lagrange multiplier (LM) tests for ARCH in the residuals of a single least squares equation			
Normal Gaussian Distribution			
F-statistic	0.2857	Prob. F(1,57)	0.5951
Obs*R-squared	0.2942	Prob. Chi-Square(1)	0.5875
Student's t with fixed df Distribution			
F-statistic	0.0506	Prob. F(1,57)	0.8229
Obs*R-squared	0.0523	Prob. Chi-Square(1)	0.8191
GED with fixed parameters			
F-statistic	0.1024	Prob. F(1,57)	0.7502
Obs*R-squared	0.1058	Prob. Chi-Square(1)	0.7450

Testing Hypothesis No.3

Table 8 shows that we cannot reject the null hypothesis which indicates that residuals are normally distributed as the P value is more than 1 % (1-confidence level (99%)) for the three distributions. This means that the third hypothesis has been fulfilled for the three distributions.

Table No. 8 Normally Distribution for Residuals					
Normal Gaussian		Student's t with fixed df		GED with fixed parameters	
Jarque-Beru	4.2940	Jarque-Beru	1.6284	Jarque-Beru	1.3506
P value	0.1039	P value	0.4430	P value	0.5090

The three models have normality of residuals and no serial correlation of the residuals and no ARCH effect which indicate that three of them can be accepted.

4.3 The Implication of the Results

These results indicate that the API is not vulnerable to global shocks and is domestically and regionally fueled runs. To explain further, our results show that most of our volatilities during the studied period, in terms of effects on the stock market, have been internal and regional such as Dubai and the Arab Spring. While external factors from outside the region might impacted the stock market, but internal factors definitely affect the market more. These particular vulnerabilities in API indicate that the stock market in Jordan does not have large exposure to international trade and thus the international or global crisis have insignificant impact on the volatility of the API.

5. Conclusion

Amman Stock Exchange (ASE) is one of earliest Exchanges in the Middle East region and one of the Jordan economy drivers. Empirical studies provided evidence that its stock prices and index is a reference for all the exchanges in the surrounding countries. In addition, this financial exchange is one of the exchanges that contagion to US and UK exchanges. Furthermore, investors in Jordan and Middle East Region as well as those around the Globe invest in Amman Stock Exchange. Therefore, this paper has offered important contributions to the existing literature about the sources of API volatility shocks if they are from its own or previous shocks on the one hand, or if they are out board shocks (DFM, FSTE and S&P 500) on the other. To investigate the API volatility shocks, we employed Generalized Autoregressive Conditional Heteroskedasticity (GARCH) methodology.

The results showed that the current volatility of APIis largely dependent on its own shocks such as previous day's API information about volatility (ARCH) and previous day's residual volatility of API (GARCH).On the other hand, we obtained evidence that external volatility and contribution of FSTE and S&P500 in the volatility of API are minimal based on the three models used in this study. However, we get evidence that Dubai Financial Market DFM contribute in the volatility of API in the three models.

In addition, it has been found that Industrial Production General Index (IPGI) does not exert significant effect upon Amman Price Index (API); this means that economic activity has no influence on stock exchange. Furthermore, testing the model under the three assumptions (Normal Gaussian assumption, Student's t with fixed df assumption, GED with fixed assumption) have shown the normality of residuals; i.e., no serial correlation of the residuals and no ARCH effect. Therefore, the assumptions can be accepted as parameters.

As far as the three estimated models are concerned, Amman Stock Exchange had clearly capture the outside effect from US and UK; this indicates the US financial and economic crisis was used by government officials and business managers as a ready excuse to justify all economic and financial difficulties Jordan faced during the past period. However, based on the results of this study, those problems and difficulties were mainly the results of domestic policies and not imported from outside.

As for capturing the effect of Dubai financial market, the real estate company, on Jordan can be considered as foggy. But the United Arab Emirates (UAE), of which Dubai is the economic capital and home to a large Jordanian expat population and there are economic linkages through various institutions and banks.

Finally, although several studies such as (Kyereboahand Agyire, 2008) and (Sirucek1, 2012) have concluded that Amman Stock Exchange is significantly correlated by the macroeconomic variables collectively and this is a usual trend as the Amman Stock Exchange reflects the economic condition of the market, our study has concluded that IPGI does not exert significant effect upon the stock exchange. This is basically due to the fact that Jordan's economy is a service oriented economy and depends on sectors, such as ICT, real estate and construction, financial services, and tourism.

REFERENCES

Ahmed M., Akhtaruzzaman, M. and Barua, S. (2006)" Effects of Monetary Policy on Price Formation of Financial Assets: A Test for Bangladesh", *Policy Analysis Unit (PAU)*, Working Paper Series No: WP 0703.

Albaity, M. (2011), "Impact of the Monetary Policy Instruments on Islamic Stock Market Index Return", Discussion Paper, No. 2011-26, Economics Open Access , Open Assessment E-journal, available at: www.economics- ejournal.org/ economics/ discussionpapers/ 2011-26.

Al Rjoub, S. (2009), "Business Cycles, Financial Crises, and Stock Volatility in Jordan Stock Exchange", available at: www.researchgate.net/publication/260293833.

Antwi, S., Zhao, X. and Mills, M. 2013 "Impact of Macroeconomic Policies on the Ghana Stock Exchange: A Cointegration Analysis", *International Business Research*, Vol. 6, No. 3.

Bjørnland, H. and Leitemo, K. (2005), "Identifying the interdependence between US monetary policy and the stock market", *Journal of Monetary Economics*, Vol. 56, No. 2, pp. 275-282, available at: https://doi.org/10.1016/ j.jmoneco.2008.12.001.

Bredin, D., et al. (2005), "UK Stock Returns & the Impact of Domestic Monetary Policy Shocks", *Journal of Business Finance and Accounting*, Vol. 34, Nos. 5/6, pp.872-882. doi;10.1111/j.1468-5957.2006.02001.x.

Budd, B. 2014" A multivariate investigation of the volatilities and co-volatilities of equity markets between Australia and three major Asian Pacific equity markets", The 27th Australian Finance and Banking Conference, Sydney, Australia.

Caldara, D. et al. (2016), "The Macroeconomic Impact of Financial and Uncertainty Shocks", *National Bureau of Economic Research NBER,* Working Paper No. 22058.

Chen, M. (2014), " Study on the Shock-transmission Mechanism of Stock Price among China, Russia and India", *Emerging Market Journals*, Vol. 4, No. 1, pp. 33-42.

Corradi, V. et al. (2010), "Macroeconomic Determinants of Stock Market Volatility and Volatility Risk-Premiums", *London School of Economics*, Working Paper.

Chatziantoniou, I. et al. (2013) " Stock Market Response to Monetary and Fiscal Policy Shocks: Multi-Country Evidence", *Economic Modeling*, Vol. 30, pp. 754-769, available at: https://doi.org/10.1016/ j.econmod. 2012.10.005.

D'Amico, S. and Mira Farka, M. (2002), "The Fed and Stock Market: A Proxy and Instrumental Variable Identification", *Royal Economic Society Annual Conference*, No. 52.

Gali, J., and Gambetti, L. (2015), " The Effects of Monetary Policy on Stock Market Bubbles: Some Evidence", *American Economic Journal: Macroeconomics*, Vol. 7, No. 1, pp. 233-257, available at: https://dx.doi.org/ 10.1257/ mac.20140003.

Gay, R. (2008), "Effect of Macroeconomic Variables On Stock Market Returns For Four Emerging Economies: Brazil, Russia, India, And China", *International Business & Economics Research Journal*, Vol. 7, No. 3.

Hussain, S., (2010), "Simultaneous Monetary Policy Announcements and International stock Markets Response: An Intraday Analysis", *Journal of Banking and Finance*, Vol. 35, No. 3, pp. 752-764.

Kearney, C. and Daly, K. (1998), "The causes of stock market volatility in Australia" *Applied Financial Economics*, vol. 8, issue 6, pp. 597-605.

Khan, W. et al. (2014), "Impact of Macroeconomics variable on the Stock Market index; A Study from Pakistan", *International Journal of Accounting and Financial Reporting*, Vol.4, No.2.

Kyereboah-Coleman, A. and Agyire-Tettey, K. (2008), "Impact of Macroeconomic Indicators on Stock Market Performance: the Case of the Ghana Stock Exchange". *Journal of Risk Finance*, Vol. 9, No. 4, pp. 365-78.

Liljeblom, E. and Stenius, M. (1997), "Macroeconomic volatility and stock market volatility: empirical evidence on Finnish data", *Applied Financial Economics*, Vol. 7, Issue 4, pp. 419-426.

Ozdagli, A. and Yu, Y. (2012), "Monetary Policy Shocks and Stock Returns: Identification through Impossible Trinity", *Federal Reserve Bank of Boston*, Working Paper No. 12-18, available at: www.bostonfedorg/ economic/wp/ wp2012/wp1218.htm.

Oluseyi, A. (2015), "An Empirical Investigation of the Relationship between Stock Market Prices Volatility and Macroeconomic Variables' Volatility in Nigeria", *European Journal of Academic Essays*, Vol. 2, No. 11, pp.1-12.

Purnomo, B. (2013), " Domestic and Foreign Shocks and the Indonesian Stock Market: Time Series Evidence", Working Paper.

Rigobon, R., and Sack, B. (2002) "The Impact of Monetary Policy on Asset Prices", *National Bureau of Economic Research NBER,* Working Paper No. 8794.

Sirucek, M. (2012) "Macroeconomic Variables and Stock Market: US Review", *International Journal of Computer Science and Management Studies*, MPRA Paper No. 39094, available at: http:// mpra.ub.uni-muenchen.de/ 39094/.

Yonis, M. (2011) "Stock Market Co-Movement and Volatility Spillover between USA and South Africa", Working Paper, UMEA UNIVERSITET.

التقلبات الفجائية لمؤشر الاسهم في بورصة عمان:
دراسة تطبيقيه بين 2011 – 2015

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ملخص

يقيم هذا البحث مصادر صدمات تقلبات مؤشر أسعار الاسهم في بورصة عمان ان كانت داخليه أم خارجية (مؤشر الاسعار في بورصة السوق المالي في دبي ومؤشر سوق الاسهم الامريكي S&P500 ومؤشر سوق الاسهم في البورصة اللندنية FTSE). تم جمع بيانات شهرية متسلسلة زمنية خلال الفترة من يناير 2011 إلى ديسمبر 2015 ، وتم تطبيق منهجية (GARCH) للكشف عن مصادر الصدمات في بورصة عمان. بينت النتائج أن التقلب الحالي لمؤشر أسعار عمان هو بسبب الصدمات الداخلية ، في حين أن التقلبات الخارجية مثل FSTE و S&P500 لم تؤثر تأثيرا معنويا بدلاله إحصائية على المؤشر. وخلصت هذه النتائج إلى أن هيئة الأوراق المالية استوعبت بوضوح تأثير الصدمات الخارجية، هذه الثغرات في المؤشر تشير إلى أن سوق الأوراق المالية في الأردن ليس له انكشاف كبير على التجارة الدولية. ونتيجة لذلك، فإن هناك فرص لتنويع الاستثمار في سوق عمان المالي من قبل مستثمرين دوليين

الكلمات الدالة: بورصة عمان، مؤشر بورصة دبي، مؤشر سوق الاسهم الامريكي، مؤشر بورصة لندن، التقلبات الفجائية، الانحدار الذاتي المعمم المشروط بعدم تجانس تباينات الاخطاء.

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