THE DYNAMICS OF THE DOW JONES SUKUK VOLATILITY: EVIDENCE FROM EGARCH MODEL

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Abstract
This paper aims to test the effect of asymmetric shocks on the volatility of the Dow Jones Sukuk. To this end, we applied the EGARCH model to give a clear idea of the effect of asymmetric shocks on the volatility of the sukuk. Considering the daily returns of the Dow Jones Sukuk for the period from 09/06/2009 to 31/12/2013, our results suggest that the volatility of the 2009-2010 period is very sensitive to market events over the period 2010-2013 and positive shocks are more volatile than negative one. The results have important implications for the sukuk market. This result can be explained by the good transparency, disclosure and better incentives that make investors expand their business in the market for sukuk.
Keywords: EGARCH, Asymmetry of shocks, Dow Jones sukuk.

1. INTRODUCTION

It is interesting to note that the prices of financial assets have witnessed strong fluctuations. These spectacular movements made financial markets volatile. Indeed, the analysis of these phenomena has its justification in the fact that financial shocks are not without consequences in terms of financial stability as they may well be accompanied by their impact on real economic sphere.

However, price fluctuations are inherent in the very existence of markets, as any worker can be exposed to risk. In this regard, the major question that the economic and financial literature was right is

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to ensure that such risk can be estimated both theoretically and empirically. In this context, several studies have equated the concept of risk to the volatility of asset returns. In fact, volatility is an essential variable in finance in that it acts as a proxy for risk. However, financial series are likely to face some problems with "stylized facts", usually summarized mainly in the volatility persistence and asymmetry of shocks.

Fluctuations in financial assets relating to the obligations are classic and Islamic. However, before going through the bond market, let's define what obligations are. Bonds are long-term debt securities that are guaranteed by a particular asset or a promise to pay. The certificate itself is an evidence of a lender-creditor relationship. This is a loan that is intended to be bought and sold.

The bond market (also known as the debt market) is a financial market where participants buy and sell debt securities, usually in the form of bonds. In 2006, the size of the international bond market was about $45 trillion. It follows from this definition that in the conventional system of the bond issue, the question of interest is at the center of any transaction. However, interest in the Islamic financial system is prohibited by sharia.

In Islam, the fixed income securities as conventional bonds are not permitted. So Sukuk is considered as securities in accordance with Islamic law. Financial assets that comply with Islamic law can be classified according to their tradability and non-tradability in secondary markets.

The value of sukuk in Malaysia is worth more than $61,000 million. This product is the first instrument of funding and liquidity in Malaysia. Indeed, sukuk have become an important and popular issue.

The convergence between Islamic and conventional finance, particularly in the case of Sukuk, is growing as expected by many researchers (Mirakhor 2006).

However, there are some differences between conventional and Islamic bonds. An obligation is a pure debt of the issuer, while the sukuk represent an interest in an underlying asset.

The investor protection mechanisms within the sukuk remain largely untested (Thuronyi, 2007). However, while the Sukuk market is developing rapidly, it remains primarily a market where holders tend to hold bonds to maturity in the secondary market (El Qorchi 2005). The offer of Sukuk now appears on specialized exchange places such as Dubai International Finance Exchange, the Stock Exchange Labuan in Malaysia, and the third market in Vienna (Abdel Khalek, and Richardson, 2007). Several stock indexes sukuk appeared as the Dow Jones Sukuk Index MENA sukuk...

Sulistya and Nursilah (2013) examined the behavior of the volatility of the sukuk market taking into account the structural breaks. Using the Dow Jones Citigroup Sukuk (DJCSI) for the period 2007-2011 as a proxy for global sukuk market, the main conclusion is that structural breaks significantly alter the behavior of the volatility of sukuk. Both authors indicate that the volatility in the pre-crisis and crisis period are more sensitive to market events in relation to the post-crisis period. Their results imply that policies needed to be a market of more rational and efficient sukuk, are: greater transparency, disclosure and better incentives to make investors expand their business activities in the secondary market.

This paper aims to test the asymmetry of shocks on the volatility of the stock index Dow Jones sukuk on the period from 09/06/2009 to 31/12/2013 and determine the structural changes for this financial series.

To meet our goal, we apply the ICSS algorithm to identify structural changes in volatility in order to test the actual existence of shocks to volatility. The existence of ruptures allows us to estimate the exponential GARCH (EGARCH) developed by Nelson (1991).

The estimate of this process is an appropriate response to address the volatility characteristics that cannot be addressed by the "traditional" methods, on the one hand and to test the effect of asymmetric shocks on volatility on the other hand. The EGARCH model was developed to model not only the excess leptokurticity but also the asymmetric effects: leverage.

The empirical contribution of this paper is to show the importance of Sukuk as of any economy financing. That is to encourage investors to buy sukuk to increase economic growth and investment.

The rest of this article is organized as follows. Section 2 describes the econometric methodology used to estimate the model. Section 3 describes the data and empirical results. Some conclusions are present in the final section.

2. ECONOMETRIC METHDOLOGY

2.1. The detection of structural changes (ICSS)

The existence of high volatility regime is an indication of structural changes in the variance process. These changes provide an approximation of the limitations of calm periods and periods of crises. The interest in the distinction of these schemes is therefore a variance to model the volatility in each market more accurately, avoid using, an over-estimation of the persistence of shocks to volatility between markets in periods of calm and turbulent times.

We will use the ICSS algorithm introduced by Inclan and Tiao (1994) and developed by Sanso et al (2004). This algorithm is based on successive iterations CUSUM test to determine the structural change points of the unconditional variance. In this algorithm, the variance of a series requires a structural change of an exogenous shock. This determines the structural changes in the volatility of the stock index returns. The performance of the stock index is given by:

$$r_t = \alpha_0 + \alpha_1 r_{t-1} + u_t$$

With a u_t stochastic series defined as follows $u_t = z_t\sqrt{\sigma_t}$ with z_t white noise such as $E(z_t) = 0$ and $var(z_t) = 1$ and follows a standard normal distribution.

The conditional u_t variance is defined as follows:

$$\sigma_t^2 = \begin{cases} \sigma_0^2 & si \quad 1 < t < c_1 \\ \sigma_1^2 & si \quad c_1 < t < c_2 \\ & \quad \dots \\ & \quad \dots \\ & \quad \dots \\ \sigma_M^2 & si \quad c_M < t < T \end{cases}$$

Or cj (j = 1 ... M) are the dates of change in trend. To estimate the number of changes in the variance of trend, a cumulative sum of squared residuals is calculated;

Either $C_k = \sum_{t=1}^{k} u_t^2, \qquad k = 1, \dots, T$, the cumulative sum of the square of the series $\{u_t\}$, the statistic D_k is calculated as:

$$D_k = \left(\frac{C_k}{C_T}\right) - \frac{k}{T}, k = 1, \dots, T and \; D_0 = D_T = 0$$

The ICSS algorithm based on the statistical D_k is used to detect multiple breaks in the unconditional variance of the series $\{u_t\}$.

When breaks points exist, D_k is different from zero. The null hypothesis of homogeneous variance $H_0: var(u_t) = \sigma^2$, Statistical D_k converges in distribution to a standard Brownian motion.

$$K^{l} *= \max{}_{\downarrow} k(\sqrt{}(T/2) \, |D_{\downarrow}k \, |$$

H_0 is rejected when is outside the critical interval $[-1{,}358 \times k^*; \; 1{,}358 \times k^*]$. In this case k^* is a break point at 95% level.

2.2. Process EGARCH (1, 1)

Overall linear GARCH is based on a symmetric process. Therefore, the positive and negative shocks of the same size are assumed to have the same impact on the conditional variance. But in reality, the asymmetric effect of shocks on volatility is very realistic for financial series. Therefore, the result based on the GARCH (1,1) may be questionable because it does not take into account the asymmetry and non-linearity of the conditional variance. To remedy these shortcomings, it seems more appropriate to apply an asymmetric GARCH model, including the Exponential GARCH (EGARCH) process characterized by an asymmetric specification disruption to consider asymmetric shocks in volatility. Thus, we estimate the EGARCH (1,1) model or exponential GARCH (1,1), which was proposed by Nelson (1991) according to the following formulation:

$$\ln(h_t) = \alpha + \beta \ln(h_{t-1}) + \delta \frac{\varepsilon_{t-1}}{h_{t-1}} + \theta \frac{|\varepsilon_{t-1}|}{h_{t-1}}$$

β is the volatility persistence parameter, if it is positive it means that positive changes in stock prices are associated with other positive changes and vice versa. The θ coefficient measures the amplitude of past error term, that is to say, the effect of information on the volatility of the previous period on the current volatility.

$\ln(h_{t-1})$ Is the variance of the previous period. Unlike GARCH, EGARCH model, it takes into account the leverage effect. The coefficient δ captures the sign of the error term. Ideally, δ should be negative which means that bad news has a greater impact on volatility than good news of the same order of magnitude. If δ is negative, the leverage exists. In other words, the unexpected price decline (bad news) induces a more than proportionate increase in the expected volatility in the case of an unexpected increase in prices (good news) of the same order of magnitude (Black, 1976; Christie, 1982).

3. DATA AND RESULTS

This study uses the Dow Jones Sukuk (IDJS) as a proxy of the global sukuk market. The sample used in this study, is a daily frequency from 09/06/2009 to 31/12/2013 (1184 observations). The data are collected from the Bloomberg database. The return is calculated as follows $R_t = LN\left(\frac{p_t}{p_{t-1}}\right)$. Results Descriptive statistics are presented in the following table:

TABLE 1 - DESCRIPTIVE STATISTICS

	T	Mean	Std-err	Skewness	kurtosis	J.B	ARCH
DJSuk	1184	0.00022	0.0038	-16.27*	526.79*	13742717*	2.354*

Table 1 shows the basic descriptive statistics for the daily performance of the Dow Jones stock index sukuk. Statistics show that the average yield sample is positive and weak. A Jarque Bera Statistics is significant at 1% level. It clearly rejects the normality assumption, which is the prerequisite for a market to be eligible for efficiency (Fama, 1965; and Kamath, 2008). The coefficients of asymmetry (skewness) and kurtosis (kurtosis) are significantly different from the levels predicted by the distribution. Indeed, the value of the coefficient of kurtosis is much greater than 3 indicating the presence of fat tails. The distribution of the series is leptokurtic. Similarly the value of the coefficient of skewness (asymmetry) is strictly, negative and different from zero, which means that the distribution of the series is asymmetrical left. The LM statistic proves the existence of ARCH effect in the return series of the stock index.

In order to estimate the EGARCH model, we apply the ICSS technique to detect breakpoints in the performance series. The estimation results of the ICSS algorithm are shown in the following Table:

TABLE 2 - DETECTION OF STRUCTURAL CHANGES (ALGORITHM ICSS)

ni	Date
1	26/06/09
2	30/07/09
3	27/08/09
4	28/09/09
5	29/10/09
6	26/11/09
7	29/03/10
8	28/04/10
9	28/07/10

The use of the algorithm leads to detect multiple plans in the variance of the series studied yields; at the number of break points from 1 to 9 (Table 2). The empirical results show that the test series separate variance regimes, corresponding to major events in the world of finance.

These dates coincide with periods of turmoil and crisis that occurred in the US stock market. For example, measurements of the unconditional variance are high in the United States for the recent period (2009-2013). Similarly, the period around the recent financial crisis (2008-2010) is characterized by high volatility regimes on the US stock market. The second half of 2009 refers in turn to strong turbulence related to the technological crisis and the bursting of the speculative bubble of April.

Finally, the period 2010-2013 is quiet for DJSUK index and thus for the US stock market. We note that this market had seen a significant increase in volatility between 2009 and 2010. This increase of the recent financial crisis through political world does not seem to have disrupted other exchanges in the region. This finding calls for caution: a crisis in a market is not necessarily contagious and its transmission to other markets depends on the nature of the crisis, the degree of reaction of markets and financial authorities and regulatory elements in place to reduce or mitigate.

In summary, the existence of these plans is an indication of structural change in the variance process. They provide an approximation of the limitations of calm periods and periods of crises. The interest in the distinction of these schemes is therefore the variance to model the volatility in each market more accurately, to avoid overestimation bias of the persistence of volatility and provide more plausible measures of cross-correlations between markets in calm periods and in turbulent times.

After testing the existence of break points in the performance series, we turn to the estimation of EGARCH model whose results are presented in the table below.

TABLE 3 - ESTIMATED EGARCH PROCESS

	Coefficient
average	0.00007
Α	-7.79***
Θ	0.397***
Β	0.362***
Δ	-0.483***

To account for the asymmetry observed in the series of our study and make it more reliable in our results, we estimate the EGARCH model. The results in Table 3 show that for the Dow Jones sukuk, the lever of δ coefficient is negative and significant (-0483), which means that there is the presence of leverage and implies that, the sukuks emitting market each price change responds asymmetrically to positive and negative information. This means that bad news (lower yields) has a greater impact on the conditional variance than good news (rising yields) of the same order of magnitude. This result is consistent with those obtained by Mahajan and Singh (2009) on the market of India and Jegajeevan (2010) on the Sri Lankan market. Furthermore, there is volatility aggregation because the coefficients of β volatility parameter is positive and significant, which confirms the persistence of shocks on volatility.

4. CONCLUSIONS

Our paper concludes that the structural changes associated with the shocks in the stock index significantly alter the behavior of the market volatility. The results suggest that the volatility of the 2009-2010 period is very sensitive to market events over the period 2010-2013 and positive shocks are more volatile than negative shocks. The results have important implications for the sukuk market. First, since the market has been affected by the recent financial crisis of 2008, it is important to understand how

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shocks are transmitted between the Islamic capital market and the rest of the world. This should take into account information and events on the market at the time of classic Islamic investment decisions. Therefore, in order to realize a more efficient and effective sukuk market, it is the necessary to implement policies that could improve transparency and information disclosure. Policies must also create better incentives to make investors expand their business activities on the secondary market and the sukuk market to increase market liquidity, which in turn causes the market to become more efficient.

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