Volatility interdependences in the Saudi stocks market

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Article Info	Abstract
	This study attempts to answer whether there is an interaction and volatility between the variances of the stock returns in the Saudi market. The sample represents daily stock prices of five sectors i.e. basic materials, banking, services, food, and transportation (SABIC, Al Rajhi, Etisalat, Almarai, and Al Bahri, respectively) from 2011 to 2016. The study applied the M-GARCH-DVEC methodology to estimate the variances of stock returns considering the interactions of returns. **Findings/Originality**: The results of the analysis show that there are fluctuations in the returns of stocks due to their interaction, but they are very slight as the results of the general trend of long-term variances. The study concludes that the variances between SABIC and Al Rajhi stocks are more stable compared to those of Etisalat, Almarai, and Al Bahri, which are relatively volatile. The results reveal that the variances in stock market returns are more likely to depend on internal factors.

Introduction

The role of the stocks market or stocks exchange affects all economic activities in a concerned country. The directions of the stock volatility determine the features of the national economy. It significantly affects the credit classification of a country and hence, the flow of the investments. That is according to the level of investment; the phases of the business cycle can be highlighted. Significantly, economic prosperity or deterioration, and flexibility are in a large extent determined by the situation at the stock market.

The importance of a stock market can be assessed according to the volume of capital invested in such a market. The comparison between the size of invested capital and the national income reflects the marginal efficiency of the national currency, and consequently, the relative strengthens of the economy. The joint movements of the stock returns, either in same or opposite directions, influence agent advice, and consequently give shape to current and future investors' portfolios status and size. Additionally, the joint movement determines the leading stock and vulnerable ones. Accordingly, policymakers stabilize the economy from up and down swings disturbances to achieve the national targets (William, 2009).

Recently, many accurate and precise models in financial econometrics dealing with the volatility of the stock markets have emerged. Such models capture different aspects of financial markets. The models detect numerical findings that play a vital role in meeting the diversity of concerns raised in this study (Wang, 2008).

This study aims to answer the question whether interactions exist in the volatility between Stocks in Saudi stock exchange. In addition, it also analyzes interrelations between volatility of the leading stocks of different industry in the Saudi stock. This study manipulated stock interrelations using the financial econometrics model (M-GARCH), which captures assets return volatility in financial markets. The applications of such models in the field of returns volatility positively

contributes in financial economics in theory and practice. By applying this kind of models which is convenient with data on stock return, this study contributes in the capability of M-GARCH model in capturing the volatility interactions in developing markets such as the KSA stocks market. It may add more value to such models in their applications to different fields with more or slight variations to advance competitive markets. It also tests the degree of accuracy to match the peculiarity of this market by giving straight forward results by the limits of volatility distribution raised by model postulates.

Volatilities and correlations are the two most essential elements in asset pricing, portfolio management, and risk assessment. One of the central aspects of financial econometrics is the modeling, measuring, and forecasting of second and possible higher moments. That is because volatilities, for instance, is not directly observable. One of the most important models for volatilities is the class of the multivariate generalized autoregressive conditional heteroscedasticity models. These models allow specifying a dynamic process for the whole-time varying variance-covariance matrix of the time series and thus jointly modeling first and second moments. The main applications of these models are portfolio management and hedging. Thus, the analysis of volatilities spillovers across markets and value at risk of portfolios are practicable. Multivariate volatilities models are extended to describe correlation time-varying features in recent years.

Although univariate ARCH/GARCH models were proved to be robust in explaining the stylized facts of univariate time series, the simultaneous examination of multivariate time series characteristics is unsatisfactory. The concern focuses on the relationship between volatilities of several markets which the univariate models seem to be not applicable. Therefore, their multivariate generalization stands out to be a better solution. There are generally two directions for modeling multivariate time series: modeling variance-covariance matrix directly and modeling the correlation between time series indirectly. The first multivariate GARCH model for the conditional variance-covariance matrix is very general and difficult to implement in practice. Bollerslev, Engle, and Wooldridge (1988) introduced a simplified version of the VEC model which significantly reduces the number of parameters. Engle and Kroner (1995) proposed the BEKK model, which can be viewed as a restricted version of the VEC model. This model has a perfect property, that is the conditional variance-covariance matrix positively definite by construction, but the model has a problem of more parameters and the hardness to interpret model coefficients.

Another direction for M-GARCH model is to indirectly model between series instead of directly modeling variance-covariance matrix. Bollerslev (1990) first introduced a class of constant conditional correlation model in which conditional correlation matrix is assumed to be constant, and thus, the conditional covariances are proportional to the product of corresponding conditional standard deviation. Cappiello, Engle, and Sheppard (2006) advocated the asymmetric generalized dynamic conditional correlation, which allows new impact and smoothing parameters for series-specific and permits conditional asymmetries in correlation dynamics.

The applications of M-ARCH models were made by Longin and Solnik (1995). They showed that the correlation in international equity returns across 1960-1990 is highly volatile. (Engle, 2002) verified the evidence of time-varying correlation of many assets' classes. Tse and Tsui (2002) applied a time-varying correlation model to exchange rate date, national stock market and spectral price data, and provided time-varying correlation evidence for three real data sets. Solnik, Boucrelle, and Le Fur (1996) found that correlations increase in high volatility period for the case of markets in industrialized countries. Bae and Karolyi (1994) found that the spillover of stock volatility between Japan and US depends on good or bad news. Edwards and Susmel (2001, 2003) investigated volatility dependence and contagion in equity and interest rate in emerging markets. Yang (2005) used a DCC model to examine the role of Japan amid the Asian Four Tigers. He found that there are stock market correlations that widely fluctuate over time. These volatilities are found to be contagious across the market.

Al Mansour (2011) found that the financial crisis has a significant effect on the KSA stock market performances. Salim and Saci (2014) studied the cointegration of stock market of the six GCC nations and concluded that there are long-run relationships between oil prices and the combined index of the Gulf Cooperation Council GCC. The study concluded that a strong equilibrium relationship exists amongst stock market prices of GCC nations. However, there are no long-run relationships between oil and stock market prices in GCC. Kalyanaraman and Tuwajri, (2014) studied macroeconomic forces and stock prices. They defined five macroeconomic variables and found that there is a long-run relationship between those variables and stock prices.

(Rehman, Hazazi, & Programe, 2014) studied the linkages between KSA stock market and selected stock market indices; UK, USA, GCC. The results demonstrated that the volatility of KSA stock market returns have decreased over years, and that correlations between markets have increased. Abdalla, (2012) studied the risk-return trade-off in emerging stock markets (Evidence from KSA & Egypt). The results show that the dynamic risk-return relationship is quite different between the Saudi and the Egyptian markets. Negative and insignificant relationship between expected return and conditional volatility were found in the Egyptian stock market while there was positive and insignificant relationship in the KSA stock market.

Methods

The analytic methodology consists of three steps: variable selection, data collection, and data analysis. The research chooses one variable (stock) in each industry included in the stock market. The variable selection depends on it is relative importance in the industry or sector. Sectors that are represented in this study are: basic materials, Banking, services, food industry, and sea transport. Consequently, simultaneous movements in stocks are likely to be generalized to all stocks present on the market.

Table 1. Stocks of the study

	Sabic	Rajhi	Etisalat	Maraie	Bahri
Nominal value	10 SR	10 SR	10 SR	10 SR	10SR
Market Value	293,400, In million SR	101,562, In million SR	149600 In million SR	63520 In million SR	1313156 In million SR
Book value	52.20 SR	32.99 SR	30.52 SR	16.70 SR	23.43 SR
Book value multiplier	1.88	1.89	2.43	4.73	1.42
Stock Profitability	4.94 SR	5.37 SR	4.75 SR	3.37 SR	2.99 SR
Profitability multiplier	16.50	11.53	15.11	31.54	11.14

Source: KSA Stock Market

With respect to data collection, the authors limited the study to the last five years, an average span of the trade cycle where short run disturbances may happen. As for data analysis, the authors suggest the multivariate GARCH (M-GARCH) model answer the questions that were raised by the study. The suggested model has the flexibility and the capability to cover the domain of the study questions (problems), and hence to provide diversified results that help achieving the study objectives. Here, the authors estimated the volatility interaction of the study stocks by using DVEC model.

Pioneer or premium stocks are stocks of firms known to be huge, well established, and financially sound for a long duration. Market values of these shares are estimated at billions of dollars with a stable financial history and a stable record of high production revenues. The corresponding

firms have a stable name in their product or service markets with large numbers of customers. They generally act well during periods of economic recession or market stagnation. Besides, these firms pay dividends to stakeholders on a current basis and enjoy a good reputation. Saudi Arabia's Tadawul has been the hugest loser in the GCC area so far, the year 2016, in which shares suffered from negative stakeholders indurations due to the indecision appearing among OPEC and non-OPEC members to freeze petrol production. Saudi Arabia has also scaled down its investments in many projects planned earlier. The value of contracts awarded plummeted by 39 percent in the first quarter of 2016, followed by a decline of 27 percent in the second quarter on a quarter-on-quarter basis. Contraction, which is paid to the economy have made stakeholders skeptical and let them too heavily withdraw from Saudi stocks. To keep the equity markets and to boost investments, Saudi Arabia submitted on September 4 the regulations on foreign investment in its securities markets, sooner than last announced.

Results and Discussion

Table 2. Method of estimate DVEC – scalar restriction

Stock	Constant	ARCH	GARCH	Variance (average)	Variance Trend
Bahri		0.1243[**]	0.8132[**]	0.00045	0.0000002
Maraie		0.2063[**]	0.6741[**]	0.00002	0.00000006
Etisalat	0.00003	0.1402[**]	0.7189[**]	0.00002	0.00000007
Rajhi		0.1885[**]	0.6347[**]	0.00002	0.00000006
Sabic		0.1317[**]	0.7461[**]	0.00003	0.00000009

After the interaction of all five stocks (sectors) which represent the Saudi stock market, there is very small long-run conditional variance amounted to (0.00003) which indicates the stability of the market or very low volatility.

Some stocks have more volatility compared to the rest of stocks, which are Bahri, Maraie. For Bahri stock (energy), the ARCH component equals (0.1243[**]), which is statistically significant and indicates the existence of heteroscedasticity. The GARCH component equals (0.8132**) which is statistically significant, and this suggests the presence of conditional variances in return. The sum of the two components is less than one, which refers to the relative stability of the stock. The sum of the two components is less than one, which means the relative stability of the stock.

Furthermore, GARCH component is greater than the ARCH one indicating that stock return depends more on nearer information or price than on far information. As far as the conditional variance is a concern, the stock has a very low variance equal to (0.00045) with very low positive trend rate throughout the study (0.0000002). Concerning Maraie (the food industry), its stock has an ARCH component equal to (0.2063[**]), which indicates the existence of heteroscedasticity. The GARCH component equal to (0.6741[**]) suggesting the presence of conditional variances in return. The sum of the two components is less than one, which means the relative stability of the stock. Furthermore, GARCH component is greater than the ARCH one indicating that stock return depends more on the near information or prices than on far information. As far as the conditional variance is a concern, the stock has a very low variance equal to (0.00002) with very low positive trend rate (0.00000006).

Etisalat stock, which represents the services sector, has median volatility compared to other stocks, which has an ARCH component equal to (0.1402[**]), which statistically significant indicates the existence of heteroscedasticity. The GARCH component (0.7189[**]) is statistically significant and indicates the existence of conditional variance in returns. The sum of the two components is less than one, which means the relative stability of the stock. Furthermore, the GARCH component
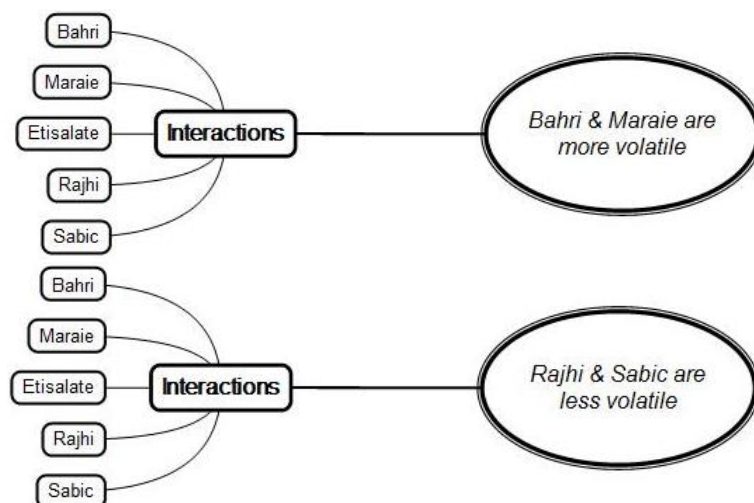
is greater than the ARCH one indicating that stock return depends more on the nearer information or price more than on far information. As far as the conditional variance is a concern, the stock has a very low variance equals to (0.00002) with very low positive trend rate throughout the study (0.00000007).
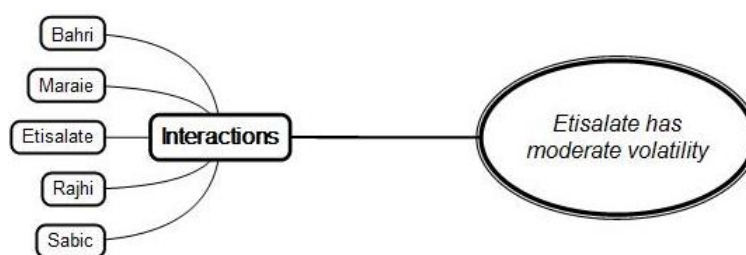
Rajhi and Sabic stocks, which represents the Banking sector and basic material sector, respectively, they have relatively low volatility. The Rajhi stock has an ARCH component equal to (0.1885[**]), which is statistically significant, indicating the existence of heteroscedasticity. The GARCH component is equal to (0.6347[**]), which indicates the existence of conditional variance in return. The sum of the two components is less than one, which means the relative stability of the stock. Furthermore, GARCH component is greater than ARCH one indicating that stock return depends more on nearer information or price than on far information. As far as the conditional variance is concerned, the stock has a very low variance equal to (0.00002) with very low positive trend rate (0.00000006). While Sabic stock has arch component equals (0.1317[**]), which is statistically significant and indicates the existence of heteroscedasticity. The GARCH component equal to (0.7461[**]), is statistically significant, suggesting the existence of conditional variance in return. The sum of the two components is less than one, which means the relative stability of the stock. Furthermore, the GARCH component is greater than the ARCH one indicating that stock return depends more on nearer information or prices than on far information. As for the conditional variance, the stock has a very low variance (0.00003) with very low positive trend rate (0.00000009).

The long-run conditional variances of all stocks, which represent the Saudi stocks market are relative with low approximate zero and very low positive trend rate throughout the study. This emphasizes the stability of the Saudi stocks market for the study (2011-2016) –the five year's plan. Maraie and Rajhi stocks have the lowest positive trends in variance, while the Bahri stock has the highest positive variance trend. Bahri stock depends highly on the nearer return information compared to rest stocks while the Rajhi stock depends lowly on nearer information compared to rest socks.

Rajhi stock is the more stable one in the market, followed by Etisalate, Sabic, Maraie and Bahri stocks. This indicates that banking is the most stable sector in the field of investment in the Saudi market. Bahri stock (energy) is the most volatile.

In general, the Saudi stocks market which is represented by the five stocks of the study is relatively stable as shown by the findings mentioned above with a tendency towards volatility but at very low trend rate near to zero in all sectors. Furthermore, the return of the market heavily depends on nearer information or prices and this reflects the dynamic property of the market.

The long-run conditional variance of each stock is relatively low and has a very slight positive trend during the period of the study (from 01/01/ 2011 to 27/09/2016). This result reflects the stability of the Saudi market. Furthermore, the confidence of the investors in the market is comparatively high. Such stability is mainly a product of increasing prices during the period of the study which was accompanied by good performances in firms.

The return of each stock depends highly on nearer information, which indicates that the Saudi market is so dynamic and contains inter-correlated stocks highly. Then, investors' expectations about the market are relatively accurate and the losses are very low.

All stocks encountered in the study are comparatively stable, which means that shocks decay slowly in the future, resulting in a relatively slow change in the market volatility. When the authors compare different stocks stability states, they observe that there are slight differences between their degree of stability. This may be due either to the relative homogeneity of the stocks or the preferences of the investors toward the stocks that are slightly different. Furthermore, the Saudi market could be classified as competitive, particularly on the way flows of information are transmitted to investors.

If the authors consider the degree of the stock stability, they observe that the Rajhi stock is the most stable (2011-2016). The result is due partly to the nature of the stock, and mainly to Rajhi comparative advantages over other bank stocks. Also, this may be due to its low-cost investment, low risk and highly profitable operations. This makes investors feeling comfortable when investing in the banking sector.

Bahri stocks which represent the energy sector detain low level of stability compared to other sectors in the study, but a lowest positive trend rate for the study which can be attributed to the fluctuations in oil prices. Moreover, the investment in the energy sector entails huge capital and hence, the high cost of operations. So, the resulting profit is relatively low. Another disadvantage of this sector, according to investors, is the long period this industry needs to reach maturity. Accordingly, to avoid losses, investors put less of this kind of stocks in their portfolio and speculate on other sectors.

Conclusion

Finally, taking in consideration the volatility interactions calculated among stocks during the period (2011-2016) and captured by multivariate GARCH (DVEC model), results revealed frequent low values in all stocks which expresses relative stability in Saudi stocks market for the five stocks governed by the study. Such stability makes the Saudi market attractive for investors and hence positively contribute to the overall stability of the Saudi economy.

The results revealed that the M GARCH (DVEC) model had precisely suited data because the results were combat with the properties of each stock. Furthermore, they were following the economic state of the country. These facts ascertain the imperative necessity for applying M GARCH model to financial data concerning developing markets such as KSA stocks market which depends beside economic factors upon some subjective and institutional factors. Hence the theoretical foundations of the model are strictly accommodated by the data, so the further

applications of the model to similar markets shall deepen the culture of econometrics literature and make profound enrichment to financial econometrics that concerns assets return volatility.

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