Impact of the U.S subprime crises on MENA stock markets: new empirical investigation[1]

Monder Cherif
Université de Reims
mondherc@gmail.com

Mouna Gammoudi
Université de Reims

The aim of this paper is to study the contagion effect of subprime crisis in Middle East and North Africa (MENA) stock markets. We use an adjust correlation coefficients and co-integration method in order to explore the short-run interdependencies and to investigate the potential time varying behavior of long-run stock market relationships among MENA stock markets and the US stock market over the period 2005-2011. Results indicated that despite the significant contagion in the MENA region, there still exist short-run diversification benefits in some of stock market mainly Kuwait, Jordan and Tunisia. The Gulf Cooperation Council stock markets appear to be more vulnerable to international movements in long-run. Morocco, Egypt and Tunisia stock markets are partially immune to external shock; this makes them suitable for portfolio diversification strategy mainly for long-term investment.

Keywords: Contagion, Co-integration, MENA, Subprime Crisis, Stock Market.

JEL Classification: G01, G15

I - Introduction

It is generally agreed by many financial economists and practitioners that there has been an increase in the degree of international financial integration over the last two decades. Several studies have suggested that increasing global integration is beneficial to growth. Bekaert et al; (2002) show that after integration, equity markets can be larger, more liquid and more volatile, and that the cost of capital declines, credit ratings improve, real exchange rates appreciate and economic growth increases, Gupta and Guidi (2012) assert that *increased financial integration among stock markets in the world motivates international investors to look for new investment opportunities in order to improve risk adjusted returns for their portfolios*. However, other demonstrate that the more integrated markets are more vulnerable to the effects of a shock in another country. For Collins and Biekpe (2003), the spread of a crisis depends heavily on the degree of financial market integration. This suggest that the less integrated countries, either by

[1] Les annexes de l'article se trouvent sur www.revuedufinancier.fr - Rubrique « Compléments »

capital controls or the lack of access to international financing, should then be relatively immune to contagion and the more globally integrated market are more susceptible to the contagion effects of a shock of another country.

Thus, many researchers have been devoted to examine how the financial crisis in one country will be spilled over to other countries. This phenomenon known under the name of "contagion" is defined by Forbes and Rigobon (2002) as a significant increase in cross-market linkages resulting from a shock hitting one country or group of countries.

The motivation behind this research is the fact that the subprime crisis event which began in autumn 2008 has again spurred the study of the contagious effect of financial crisis. It has not only affected the US economy, it has spread to other countries as well, both developed and developing nations. The initial impact of the international financial collapse was felt in Middle East and North Africa stock markets (MENA) countries to different degrees.

After the insolvency of Lehman Brothers was announced, on September 15th 2008, the Saudi Arabian stock market fell by 6.5%, Doha 7%, Kuwait 3% and Abu Dhabi 4.35%.[2] In contrast, some MENA stock markets were relatively unaffected by these fluctuations, as those in Morocco, Lebanon and Jordan, with accumulated falls from January 2008 to March 2009 of between 13 % and 28%, respectively. The behavior of Tunisia's stock market was particularly noteworthy, with an accumulated growth in this period of 18%.[3]

For a better understanding of how the recent financial crisis affected the MENA region[4], we investigate empirically whether any of these stocks have been affected by the US subprime crisis. To this end, we employ an adjust correlation coefficients and co-integration method in order to explore the short-run interdependencies and to investigate the potential time varying behavior of long-run stock market relationships among MENA stock markets and the US stock market. The empirical work was based on a sample of daily closing stock index prices, covering the period from Mars 15, 2005 to December, 2011. We define two sub-periods (tranquil period and turmoil period) in order to be able to examine the possible change in co-movement relations.

The paper is organized as follows. The section 2 provides an analysis of the MENA stock markets. Section 3, presents a literature review of the impact of the US subprime crisis on stock markets. Section 4 focuses on the data and methodology aspects of the paper. Section 5 deals with the main results of our empirical testing. Section 6 provides the summary ok key findings and concludes the paper.

II - Analysis of the MENA stock Markets

Before we examine the effect of the crisis on the stock markets of the MENA countries, it may be useful to examine the development of stock market in the region over the period understudying.

Table 1 presents the market capitalization of listed companies of each country and the market capitalization in percentage of GDP from 2005 to 2010[5]. The market capitalization of shares listed on the Saudi Arabia stock exchange is the largest among the MENA countries. Record market capitalization growth rates can be noted in Egypt and Jordan and to a lesser extent in Kuwait, over the 2005'2007 period prior to the financial crisis.

[2] *Casa Árabe Economy and Business Bulletin*. Nº13. August 2009, Page 11.

[3] IMF. *Regional Economic Outlook. Middle East and Central Asia*. May 2009. Page 14

[4] In this paper the oil producing MENA countries or Gulf Cooperation Council (GCC) Countries are Kuwait, Saudi Arabia , Qatar, and the United Arab Emirates, while the non-oil producing MENA countries are: Egypt, Jordan, Morocco, Turkey and Tunisia.

[5] *World Development Indicators available until 2010*

This is due to massive privatization schemes introduced in those countries, and to the extensive sale of government assets to private firms, and to the considerable efforts devoted recently in enhancing the efficiency, depth, integration, and liquidity of the three stock markets. As we can see above, the impact of the global financial crisis on MENA market capitalization varied significantly from one country to another. On average regional market capitalization have fallen by about 42% between 2007 and 2008. In Egypt and Jordan declined significantly in between 2007 and 2009 as a result of the global financial crisis, from $139.3 and $41.3 billion in 2007, to $89.95 and $31.86 billion respectively in 2009.

Among the non-oil producing MENA countries, Table 1 indicates that Morocco experienced a milder stock market capitalization decline from $75.5 billion in 2007 to $62.9, while the Turkey's stock market capitalization was declined by more than half in 2008.Tunisia stands alone in experiencing an improvement in its market capitalization from $5.3 billion to $9.1 billion in between 2007 and 2009. Stock market capitalization in the oil producing MENA countries has declined significantly in between 2007 and 2009 as a result of the global financial crisis. In the Saudi Arabia it reached US$ 318 billion, around 38% less than its value in 2007. While, UAE and Kuwait decreased by 56% and 43% respectively from 2007 to 2009.

Moreover, to clearly understand the stock market size evolution in MENA region, we examine the evolution of stock market capitalization to GDP ratio in MENA region. Table 2 indicates that during the period under review, Market capitalization to GDP of MENA market declining sharply, it dropped by 52% on average. The UAE stock market has registered the largest drop of 65% caused by the world financial crisis. It is followed by Turkey and Saudi Arabia (63% and 61% respectively). Kuwait and Egypt declined by more than 50%. It should be mentioned that, in spite of its increase, Tunisian market capitalization makes up only 21% of GDP. It worth mentioned that Jordan leads the region in terms of market capitalization over the last decade.

Turnover ratio [6] seems to discriminate well between MENA stock markets (see Table 3). Based on this measure the Saudi Arabia appears as the sample's most liquid market (187%), during the period 2005'2009. It is followed by Turkey, UAE and Kuwait (138%, 77% and 73% respectively). The smallest market in terms of turnover ratio level was the Tunisian market by 17.7%.

Figure 1 (see appendix) displays the daily stock indices evolution of MENA Countries over the period from 2005 to 2011. A careful examination of the data reveals that during the crisis period the domestic stock price indices in all the GCC stock market witnessed a sharp fall in 2008. Figure show that UAE stock market has witnessed the biggest fall followed by Saudi stock market. On average, the non-oil producing MENA countries witness volatility less than GCC countries.

To visualize the returns for each market, we depict the series in Figure 2. With the exceptions of non-oil producing countries, the plots show a clustering of larger return volatility around and after mid September 2008 date of Lehman Brothers bankruptcy.

III - Literature Review

Although the international impact of the US subprime crisis on stocks market is non-negligible and has spread to markets worldwide. Research studies of its contagious effects are still scarce. In this section, we recall the main research papers in this subject.

[6] *Turnover ratio is the total value of shares traded during the period divided by the average market capitalization for the period.*

Horta et al; (2008) tried to assess financial contagion resulting from the US subprime crisis to developed countries market as well as checked if the intensity of contagion differs across countries. Results suggest that stock markets in Canada, Japan, Italy, France and the United Kingdom display significant levels of contagion, which are less relevant in Germany and mainly in the Portuguese market. Canada appears to be the country where the highest intensity of contagion is observed. In the other paper, Horta et al; (2009) examined the financial contagion from the US subprime crisis to the European markets in the NYSE-Euronext group. They find that with the exception of the industrial sector of the Belgian stock market, contagion from the US subprime crisis spread to all analyzed markets. Choy Yoke Chong (2011) attempted to study the effect of subprime crisis on U.S. Stock market return in term of stock return and volatility. For this respect daily data of S&P 100 stock indexes for the period of May 2006 to December 2009 are studied using basic GARCH model. He divided data into three different sub-periods as following: early stage of Subprime crisis, recession of U.S. and period after the bankruptcy of Lehman Brothers. The author revealed that the bankruptcy of Lehman Brothers following the Subprime crisis turned out to have bigger impact on stock market volatility but not on the stock returns in general. In the same line of research Hakan et al; (2010) studied the impact of the bankruptcy of Lehman Brothers on the volatility structure of Turkey price index (ISE-100) by using ARCH-GARCH models proved a standard deviation and the volatility of ISE-100 index increased in bankruptcy period. To test whether interdependencies between world capital markets are stronger during times of growth or during periods of crisis Moldovan and Medrega (2011) have considered a time series representing the daily values of three main stock markets index in the world namely that of the New York Stock Exchange (Dow Jones Industrial Average), that of the London Stock Exchange (FTSE) and that of the Tokyo Stock Exchange (Nikkei) between January 2004 and May 2011, and they divided period into two intervals as following:

- January 2004 ‘ June 2007 ‘ before the crisis, when the global economy was in the expansion stage of the economic cycle
- July 2007 ‘ May 2011 ‘ when the global financial system and the world economy went through difficult times marked by the advent of the financial crisis in the United States, its expansion worldwide, the global recession and the time of economic recovery.

The research has shown that the relation between the three stock market indexes have been stronger during the financial crisis that broke out mid-2007 than before the crisis. This result is explained by the fact that investor panic at times of crisis is more intense than enthusiasm expressed during growth periods.

Among other results they find for example that the Dow Jones was correlated negatively with the Nikkei during the crisis, and the Japanese index had a lower influence on the American index than before the crisis. The negative correlation between the two indexes as explained by the authors is that with the advent of the crisis in the United States, investors started closing positions on the American market and invest their money in stock traded on the Tokyo Stock Exchange.

Moosa (2010) evaluated the effects of the crisis on the six oil-exporting countries of the Gulf Cooperation Council: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. Specifically, he deals with stock market contagion during the early stages of the crisis (2007-2008). The empirical results show a limited evidence for the effect of U.S. stock prices on GCC stock prices and a much more important role for oil prices. However, neither of these variables alone can explain the behavior of GCC stock prices during the period under investigation because of the role played by the domestic factors that caused bubbles and crashes. Naoui et al; (2010) used a dynamic conditional correlation model to examine financial contagion phenomenon following the American subprime crisis. Their sample consists of six

developed countries, including the crisis-originating American market, and ten emerging countries. To this effect, they used stock indices daily returns of these markets observed for the period from the January 3rd 2006 to February 26th 2010. They concluded that during the subprime crisis, contagion is strong between the US and the developed and emerging countries. More specifically, they noted that returns conditional correlations of the S&P 500 stock index and the five developed markets (France, Germany, Italy, Netherlands, and United Kingdom) considerably increased during the crisis period with values sometimes exceeding 80%. In the case of emerging markets, the results show that conditional correlations vary according to three types of groups. The first group, including Brazil, Mexico and Argentina, is characterized by a high dynamic conditional correlation with the US market. The second group, composed of India, Malaysia and Singapore, presents correlations variable in time and do not exceed 50%. The third group, composed of China, Hong Kong, Korea and Tunisia, records weak dynamic conditional correlations with the US market and seems unaffected by the subprime crisis.

Khallouli and Sandretto (2012) extended a Markov-Switching EGARCH model in order to test "contagion" from the US stock market to eight MENA stock markets. Among other question studied in this research they examine if "contagion" occurs into countries which have poorly liberalized their financial system, as it is the case for some of them in the region. They prove evidence of mean and volatility contagion in MENA stock markets caused by the US stock market. Specially, they have found mean and volatility contagion in the Bahrain and Egypt stock markets. Theirs results highlight a significant increase in the likelihood of crisis occurrence characterized by low return and high volatility, following the US stock market fall and the US volatility rise. In the case of Morocco and Turkey the authors reveal a mean contagion, while the contagion to Oman and Dubai is explained only by the US volatility. Furthermore, they asserted that the financial crisis was affected a large variety of markets, regardless of their characteristics (size of the market, liquidity, stage of liberalization, level of international financial integration and so on). Furthermore this impact did not relate to the type of specialization of the countries under consideration (oil exporting countries or more diversified economies). This suggest that international portfolio diversification in segmented MENA equity markets has not really been an efficient instrument of immunization against the risk of contagion.

Very recently many studies have propelled to look for the relation between subprime crisis and Islamic stock market, for example Karim and al. (2010) examined the effects of the current global crisis on the integration and co-movements of selected Islamic stock markets. Using time series techniques of co-integration over the period spanning from February 15, 2006 to December 31, 2008. In order to explore changes in the stock market integration and co-movement, they divide the period of analysis into two periods, namely the pre-crisis period (February 15, 2006-July 25, 2007) and during crisis period (July 26, 2007-December 31, 2008). They find no evidence of co-integration among the Islamic stock markets in both periods. Accordingly, the 2007 subprime crisis does not seem to affect the long-run co-movements among the Islamic stock markets. Authors suggested that the Islamic stock markets provide opportunity for the potential benefits from international portfolio diversification, even after the subprime crisis. They concluded that the prohibition of riba, gharar and maysir is one of the plausible reasons of no co-integration in the Islamic stock markets. In contrast of this study kassim (2010) analyzed the impact of the 2007 global financial crisis on the integration of the Islamic stock markets. Focusing on Seven Islamic stock markets, specifically, four are from the developing countries, namely Malaysia, Indonesia, Turkey and Kuwait, and three are from the developed countries, namely the US, UK and Japan. Among other results show that the Islamic stock markets are as vulnerable as the conventional stock markets to the global

financial shocks. This is reflected by the lower returns and more volatile nature of the Islamic stock markets in the crisis period than the non-crisis period.

IV - Data and econometric methodology

1 - Data and Descriptive Statistics

The sample consists of daily closing stock index prices of Jordan (AFM), Morocco (MASI), Egypt (EEGX30), Kuwait (KSE), Qatar (QEI), Saudi Arabia (TASI), Tunisia (TUNINDEX), Turkey (ISE100), United Arab Emirates (DFM) and USA (DJIA) from Mars 15, 2005 to December, 2011. All indices have been obtained from Thomson Financial DataStream and they are in domestic currency in order to avoid problems associated with transformation due to fluctuation in exchange rates (Neaime,S, 2012 and Gupta, R. and Guidi, F, 2012). We choose a log-transformation of the data in order to interpret the links between variables in terms of elasticity. We define two sub-periods in order to be able to examine the possible change in co-movement relations .The date of the crisis period is based on the dates suggested by Bartram and Bodnar (2009) which indicated that the global equity market crisis can be dated around September 15, 2008, the day of Lehman Brothers bankruptcy. Thus the two sup-periods are as following:

- First sub-period: from 15-03-2005 to 15-09-2008 (pre-crisis period or tranquil period)
- Second sub-period: from 16-09-2008 to 31-12-2011 (crisis period or turmoil period)

Table 4 reports some descriptive statistics for the daily returns[7] for the two sub period. As showed in bellow the Kurtosis coefficient for all stock market returns is largely sharper than a normal distribution (>3) mainly after crisis. it confirms a great probability of the occurrence of the extreme values. Furthermore Skewness indicators indicate the asymmetry and deviation for most series of daily returns from a normal distribution. This asymmetry results in the fact that volatility is lower after a rise than after a fall of profitability since a negative shock has more effect than a positive shock. In short, these statistics shows the existence of a leptokurtic form of the empirical distributions and that all these characteristics are specific to the financial variables at high frequencies. The Jaque-Bera test of normality reveals a null probability ($P < 0.05$) suggesting that all stocks market returns are compatible with a Normal distribution.

2 - Methodology

Our first empirical test of contagion in MENA stock markets adopts an heteroskedasticity adjusted correlation, as proposed by Forbes and Rigobon (2002) in order to highlight the short-run interdependencies. In addition to supplement the short-run analysis, co-integration tests are also run to distil long-run co-movements between the U.S. and MENA stock markets. Co-integration analysis will be conducted at both bivariate (Engle Granger co-integration test) and multivariate levels (Johansen co-integration test) in order to obtain more insight into the interrelationships among our markets of concern. Focusing only on bivariate or only on multivariate co-integration analysis might miss important information because it is possible that variables are not cointegrated at bivariate level but are cointegrated collectively.

[7] The return is calculated as first differences in natural logarithms according to the following expression: $R_t = \ln (p_t / p_{t-1})$

V - Main results of the analysis

1 - The adjust correlation coefficient

In Table 5 we report the adjust correlation coefficient of the daily market returns as represented by Forbes and Rigibon (2002) the critical value for the t-test at the 5% level is 1.65,so any test statistic greater than this critical value indicates contagion (C) , while any statistics less than this value indicates no contagion (N).

Results show firstly, on average the adjusted correlation coefficient neatly increased just after the 2007 subprime crisis. Secondly, the t-Students values of the adjusted correlation coefficients are significant for Turkey, Saudi Arabia, Morocco, Egypt, UAE and Qatar. The adjusted correlation coefficients between the US market and these markets increased between the two periods, this gives support to the contagion hypothesis after the subprime crisis. However, t statistic value for Jordan (1.19) are inferior to the critical value (1.65), leading us to accept the null hypothesis according to which US stock returns have a statistically non-significant effect on Jordan market returns. In this case, we witness an interdependence phenomenon between the markets and the US market and not a pure contagion.

Thirdly, relevant contagion effects occurred especially from US to Turkey stock market returns. However results suggest that there is no evidence of contagion for the case of Kuwait and Tunisia stock market returns.

Overall, the results from the adjust correlation coefficients may suggest some conclusions concerning the short-term relations between MENA stock market and US stock market. One is that the correlation coefficients indicate there are short term co-movements between MENA stock markets (Turkey, Saudi Arabia, Morocco, Egypt, UAE and Qatar) and US stock market, which suggests that contagion effects exist in the region. Despite the significant contagion in the MENA region, there still exist short-run diversification benefits in some of stock market. In particular the Kuwait, Jordan and Tunisia stock markets are not significantly affected by the subprime crisis, suggesting the potential diversification benefits in these markets.

2 - The Augmented Dickey'Fuller Test

A necessary condition to perform a co-integration test is that the order of integration of variables has to be the same. In order to detect the order of integration we employed the Augmented Dickey'Fuller (ADF). Test results for the two sub-samples are shown in Table 6. The null hypothesis of a unit root is not rejected for all indices in log levels, whereas it is rejected when they are taken in their log first differences. Thus, all series are integrated of order one I (1) at 5% level. As such, it is possible that some combinations of them are cointegrated. We use therefore the Engel Granger co-integration test and the Johansen's approach to test this possibility.

3 - Engel-Granger co integration test

In our study, the Engel Granger co-integration test is employed to test the bivariate long-run relationship among the stock market indices after and before subprime crisis.

If two stock market price indices are found to be cointegrated, it implies that there is a long-run equilibrium relationship between them, and even though the price series themselves may be non-stationary, they will nevertheless move closely together over time.

Focusing on the period before crisis (see Table 7), the Engel and Granger co-integration test indicate a weak co-integration among MENA stock markets, there is evidence of co-integration between Jordan and Qatar and between Qatar and UAE. Furthermore results reveal the absence of co-integration between these markets and US stock market.

After subprime crisis, all GCC stock markets (Saudi Arabia, Kuwait, Qatar and UAE) and Jordan become cointegrated to the US market. Jordan and Qatar remain cointegrated. Saudia Arabia and Turkey, Kuwait and Jordan become cointegrated.

Marocco, Egypt and Tunisia appears to have particular behavior compared to the other MENA stock markets of this study. They are not cointegrated to any other MENA stock markets or to the US stock market, in any case. This means that there are potential benefits for portfolio diversification of international investors aiming to diversify into these stock markets. However, The GCC stock markets appear to be more vulnerable to international movements in long-run.

4 - Johansen co-integration test

In order to further investigate co-integration results, we employ Johansen co-integration test. Johansen's procedure requires estimating a VAR (p). In order to estimate the optimal number of *lag p* of the VAR we used the Akaike Information Criterion (AIC). After estimating the VAR models with the optimal number of lags we are able to conduct a multivariate co-integration test.

Table (8) and (9) show results of the trace and Max-Eigen tests, respectively. For the sake of discussing, we use three Panel, Panel A which included all stock markets, Panel B is consisted of those non GCC stock markets(ISE100, MASI ,TUNINDEX and EEGX30) and Panel C comprised of those GCC stock markets and Jordan[8] (TASI, KSE, DFM, QEI and AFM).

Empirical findings (Panel B of Table 9 and Table 10) indicate that there is no long term relationship among the four non GCC stock markets before and after the U.S subprime crisis at 5% level of significance. Since these stocks do not share a long-run equilibrium relationship, which implies that they do not have a tendency to move together towards the same direction in the long-run, then these markets are not integrated and thus provide some diversification benefits for the investors.

For the Panel C, Focusing on after crisis period, the Trace statistics as well as the on Max-Eigen statistics indicate the existence of co-integration among the GCC stock markets and Jordan stock market. As shown, the null hypothesis of absence de co-integration is rejected. On the other hand, we accept the null hypothesis of existence of at most only one co-integration relationship between the selected stock indices. The evidence of co-integration between these stock markets reveals the presence of high long-run interdependence between them. We infer that there are permanent channels which assure the international transmission of financial shocks among theses markets. After the crisis period, they become more cointegrated (we accept the null hypothesis of existence of at most two co-integration relationships). This suggest that the GCC stock markets and Jordan stock market are highly integrated during the crisis period which could suggest the aggregate behavior of the investors who become vigilant in all stock markets following the news of the sub-prime.

VI - Summary and Conclusion

In this paper we attempt to investigate empirically whether any of the stock markets of MENA region have been affected by the US subprime crisis. To this end we have estimated an adjust correlation coefficients in a manner, following Forbes and Rigobon (2002) in order to explore the short-run interdependencies. Second, we have employed co integration method to investigate the potential time varying behavior of long-run stock market relationships among MENA stock markets and the US stock market. There are several empirical findings. Results

[8] *We chose this panel because Jordan have strong economic linkages with GCC through remittances, FDI and tourism, or with strong dependency on foreign aid, or both.*

reveal that despite the significant contagion in the MENA region, there still exist short-run diversification benefits in some of stock market mainly in Kuwait, Jordan and Tunisia.The GCC stock markets appear to be more vulnerable to international movements in long-run. Morocco, Egypt and Tunisia stock markets are partially immune to external shock. This makes them suitable for portfolio diversification strategy mainly for long-term investment.To sum up, we can infer from our research the important magnitude of the subprime crisis which has affected a large variety of stock markets, regardless of their characteristics (size of the market, stage of liberalization or level of international financial integration) This result is confirmed by a number of previous studies like Khallouli and Sandretto (2012).

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