Correlation between Islamic stock and Commodity markets: An investigation into the impact of financial crisis and financialization of commodity markets

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Abstract

The repercussions of the recent financial crisis were felt over different parts of the world causing much calamity to different markets, economies and investors. The capital markets, in particular, took a severe hit during the crisis plummeting to all-time lows. However, before the crisis, the significant rise in commodity prices since 2002 and their subsequent fall since July 2008 have revived the debate on the role of commodities in the strategic and tactical asset allocation process. Therefore, the understanding of relationship between commodities and stock markets is crucial, especially during the crisis, when investors are looking for alternative investment opportunities. In this paper, we focus on commodity markets and their relation with Islamic stock markets during the recent financial crisis. This is the first attempt to study this relationship in the important and growing area of Islamic capital markets with the help of the recent dynamic conditional correlation (DCC) GARCH methodology. The focus of the study is to look into the dynamics of the correlations between both markets, and analyze whether those time-varying correlations evolve according to the situation—bullish or bearish—in the stock market. This paper investigates the links between price returns for 5 commodity sectors and Islamic stock market over the period from January 2001 to March 2013, by paying a particular attention to the Energy sector. We show that the correlations between commodity and Islamic stock markets evolve through time and are highly volatile, particularly since the 2007-2008 financial crises. The latter has played a key role, emphasizing the links between Islamic stock and commodity markets, and underlining the financialization of commodity markets. At the idiosyncratic level, a speculation phenomenon is highlighted for energy sector (oil), while the safe-haven role of precious metal sector (gold) is evidenced.

Keywords: Islamic Capital Market, Commodity Market, Financial Crisis, Multivariate GARCH Dynamic Conditional Correlations.

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1.0 INTRODUCTION

Islamic banking and finance has mushroomed into an increasingly substantial segment of the global financial market leading to the crystallization of the Islamic stock market, in particular, as a viable alternative to its conventional counterpart. It is in the wake of the global economic meltdown that Islamic finance has been put in the limelight as a force to be reckoned with.

With Muslim societies becoming more sophisticated and their financing needs more complex, coupled with stagnating Islamic thought evolution, there comes a need to strengthen the current Islamic financial system, in particular the equity market. The wider acceptance of equity investments by Shariah scholars in the early 1990s paved the way for the launch of equity markets compliment with the teachings of Islam.

Further, the establishment of credible equity benchmarks such as Dow Jones Islamic Market Index (DJI) and FTSE Global Islamic Index Series has been a turning point for the industry, providing a comparative platform between indices.

Throughout the last decade, commodity prices experienced an exceptional volatility, with simultaneous and alternating phases of rising and falling trends. This evolution can be compared to that of Islamic financial markets, as illustrated by Figures 1 and 2 representing the Dow Jones Islamic Index and Dow Jones Commodity spot price returns' volatility.

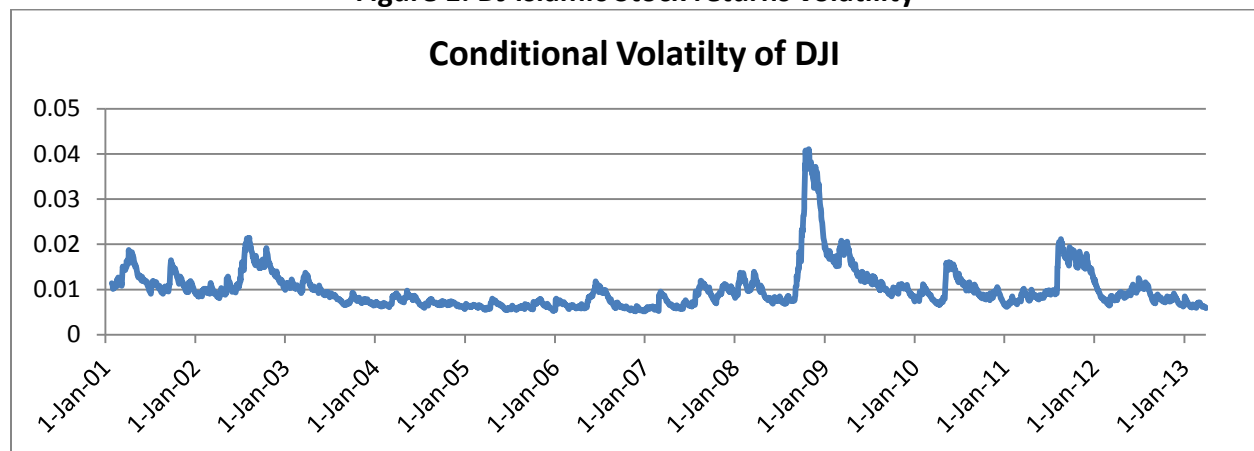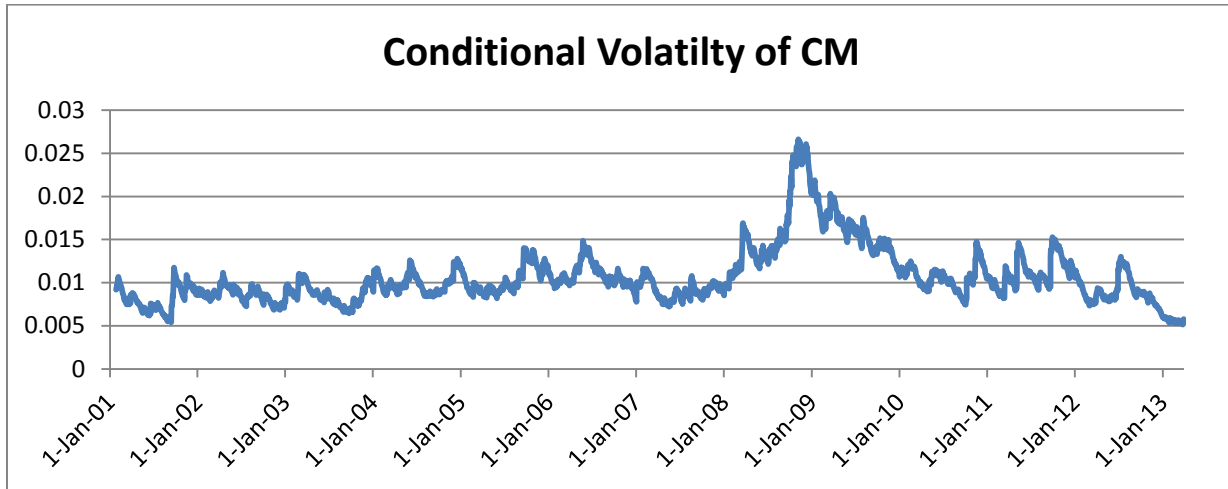**Figure 1: DJ Islamic Stock returns volatility**

Figure 2: DJ Commodity spot price volatility

As shown in Figure 3—which displays the dynamics of the DJ Islamic and DJ Commodity spot price indexes—commodity prices have experienced a drop during the 2007-2008 financial crisis, and their link to the Islamic stock prices seems to have strengthened since that turmoil. At the same time, commodities increasingly become part of portfolio allocation, together with stock classes.

Figure 3: Dynamics of DJ Islamic Price Index and DJ UBS Spot Commodity Index
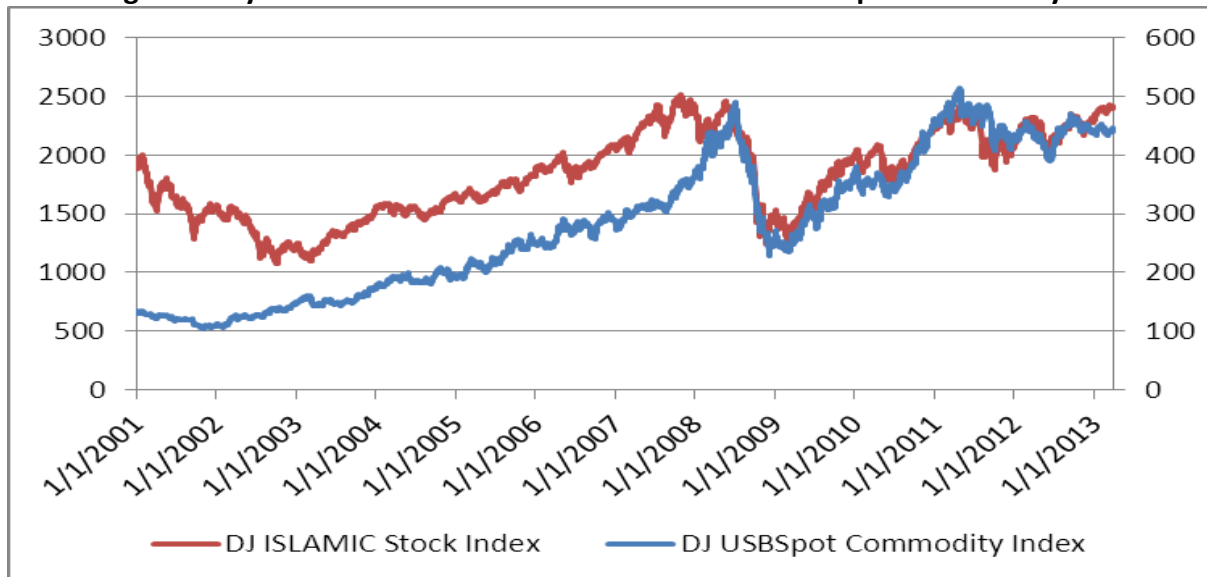
At a macroeconomic level, policymakers pay a particular attention to commodity prices and their volatility given their potential to feed inflation pressures. Volatility of commodity prices is thus a central issue for the world economy.

Moreover, analyzing the links between commodity and Islamic capital markets is of particular interest for financial players as raw materials enter many investment portfolios, together with stock classes (Dwyer et al., 2011; Vivian and Wohar, 2012). Furthermore, as documented by Choi and Hammoudeh (2010), commodity traders concurrently look at both stock and commodity markets fluctuations to infer the trend of each market. Comparing the dynamic volatility of raw materials and Islamic equity prices provides useful information about possible substitution strategies between commodity and stock classes. In particular, volatility plays a key role regarding hedging possibilities, and impacts asset allocation across raw materials and their risk-return trade-off.

Building on the observed links between commodity and stock markets, a recent literature has emerged regarding the impact of investors' behavior in explaining the increase in both level and volatility of commodity prices. But , as underlined by Vivian and Wohar (2012), no clear-cut conclusion has been reached so far. However, the relationship between commodities and Islamic stock markets is still an unchartered area and to the authors' knowledge there is no research so far done in this area.

In this paper, we humbly try to contribute to the emerging empirical literature dealing with the relationships between commodity and Islamic stock markets. More specifically, the focus is on the dynamics of the correlations between both markets, and analyze whether those correlations evolve according to the situation—*bullish or bearish*—in the stock market. We pay a particular attention to the recent 2007-2008 financial crisis by investigating whether it has strengthened or disrupted the links between Islamic stock and commodity markets. From a methodological viewpoint, we follow the dynamic conditional correlation (DCC) GARCH approach which allows to assess the changes in correlations between commodity and stock returns over time. The sample for research consists of 6 different sector commodity spot price indices covering over the period from January 3, 2001 to March 28, 2013. This research paper

allows us to study whether commodities constitute an homogenous asset class with regard to their links with Islamic stock markets, and whether the crisis has caused the financialization of commodity markets.

The results show that correlations between commodity and Islamic stock markets are time-varying and highly volatile. The impact of the 2007-2008 financial crisis is noticeable and even the impact of recent US debt-ceiling crisis can be observed. It emphasizes the links between commodity and Islamic stock markets, and highlights the financialization of commodity markets. We also show that, while sharing some common features, commodities cannot be considered a homogeneous asset class: a speculation phenomenon is for instance highlighted for energy sector comprising oil, while the safe-haven role of gold is evidenced, which constitutes a part of precious metal sector.

The rest of the paper is organized as follows. Section 2 briefly reviews the literature about the links between commodity and stock markets. Section 3 presents the data and methodology, and Section 4 shows empirical results and discussion, and Section 6 concludes the paper.

2.0 LITERATURE REVIEW

As documented in the introduction, commodity markets share several characteristics with stock markets and financial assets. So far the literature has analyzed this phenomenon mainly by focusing on conventional stock markets, and looking at the co-movements between conventional stock and oil markets. Most of this literature offers substantial evidence on the impact of oil on stock prices, putting forward a negative relationship between oil price and stock market returns. For instance, Jones and Kaul (1996), using a standard cash-flow dividend valuation model, find a significant negative impact of oil price shocks on US and Canadian quarterly stock prices in the postwar period. Several models, relying on some variants of Vector Autoregressive analysis (VAR), highlight similar findings. Park and Ratti (2008), performing a multivariate VAR analysis, find statistically significant impact of oil prices shocks on real stock returns for US and 13 European countries over the period from January 1986 to December 2005.

Sadorsky (1999) investigates relationships among monthly oil prices, S&P 500 conventional stock returns, short-term interest rate, and industrial production for the January 1947-April 1996 period by means of an unrestricted VAR model. The author shows that oil prices and oil price volatility both play important roles in affecting S&P 500 stock returns. Papapetrou (2001) estimates a vector error-correction model on monthly data for Greece from January 1989 to June 1999, and concludes that oil prices drive stock price dynamics.

Shifting from the study of co-movements to volatility analysis, the most recent literature focuses on volatility spillovers between oil/industrial commodity and conventional stock markets. Hammoudeh et al. (2004) investigate the spillover effects, day effects, and dynamic relationships among five daily S&P oil sector stock indices and five daily oil prices for the US oil markets from July 17, 1995 to October 10, 2001 using co-integration techniques as well as ARCH-type models. They evidence volatility spillovers from the oil futures market on the stocks of some oil sectors. They also find an oil volatility transmission day effect, Friday having a calming effect on the volatility of oil stocks. Chiou and Lee (2009) examine the asymmetric effects of WTI daily oil prices on S&P 500 stock returns from January 1, 1992 to November 7, 2006, by investigating structure changes in this dependency relationship. Using the Autoregressive Conditional Jump Intensity model with expected, unexpected and negative unexpected oil price fluctuations, they find that high fluctuations in oil prices have asymmetric unexpected effects on stock returns. Malik and Ewing (2009) rely on bivariate GARCH models to estimate the volatility transmission between weekly WTI oil prices and equity sector returns from January 1, 1992 to April 30, 2008 and find evidence of spillover mechanisms. Focusing on the Brent market, Filis et al. (2011) analyze time-varying correlations between oil prices and stock markets by differentiating oil-importing (USA, Germany, and the Netherlands) and oil-exporting (Canada, Mexico, and Brazil) countries. Using the multivariate DCC-GARCH approach from January 1988 to September 2009, they find that the conditional variances of oil and stock prices do not differ for oil-importing and oil-exporting economies. However, time-varying correlations depend on the origin of the oil shocks: the response from aggregate demand-side shocks is much greater than supply-side shocks originated by OPEC's production cuts. Finally, Choi and Hammoudeh (2010) extend the time-varying correlations analysis by considering

commodity prices of Brent oil, WTI oil, copper, gold and silver, and the S&P 500 index from January 2, 1990 to May 1, 2006. They show that commodity correlations have increased since 2003, limiting hedging substitutability in portfolios.

Keeping in view the lack of literature, especially on Islamic stock indices, this study explores the relationship between different commodities spot indices and Islamic stock indices. I consider 5 different commodity sectors indices, traded in the US: Energy, Precious metals, Agricultural, Non-ferrous metals and Softs. The study allows to compare the behavior of each sector spot index with Islamic stock market fluctuations, and to study whether correlations between commodities and Islamic equities evolve over time and depend on the situation—bearish or bullish—on the stock market.

3.0 DATA AND METHODOLOGY

The empirical study portion of this research is a multi-step process, where we attempt to sequentially analyze the data starting from simple descriptive statistical numeric. The crux of our model attempts to study the volatility of commodity sector spot indices and Islamic equity index. All the commodity and stock indices used for the empirical study have been taken from the Dow Jones Indices family.

We consider daily spot price series extracted from DataStream for the different sector commodities over the January 3, 2001 - March 28, 2013 period. We investigate 5 different commodities sectors: energy, precious metals, agricultural, non-ferrous metals and softs spot index. All price series are quoted in US dollars. An aggregate commodity price index, the DJ Spot commodity Index, is also considered. Regarding the equity market, we rely on Dow Jones Islamic index.

Table 1: Details of indices

Details of the variables used in the study	
DJI	DJ ISLAMIC - Price Index
CM	DJ UBS-Spot Commodity Index
EY	DJ UBS-Energy Spot Index
ML	DJ UBS-Industrial Metal Spot Index
AR	DJ UBS-Agriculture Spot Index
PM	DJ UBS-Precious Metals Spot Index
ST	DJ UBS-Softs Spot Index

To investigate the time evolution of correlations between the stock and commodity markets, we rely on the dynamic conditional correlation (DCC) GARCH models. To address the research objective, we have used Multivariate Generalized Autoregressive Conditional Heteroscedastic (MGARCH) model. Initially we test the variables on both Normal and t-distribution to determine which distribution is a better fit to the set of variables. To have a cursory glance at the founding basis for our research objective, regarding whether correlations between commodities and Islamic equities evolve over time and depend on the situation, the empirical results of unconditional correlations coefficients will suffice.

However, to address the research objective in specific, we utilize MGARCH DCC. The DCC model allows us to observe and analyze the precise timings of shifts in conditional correlation. Estimation of DCC is a two-step process to simplify estimation of time varying correlations. In first stage, using GARCH model for each variable, univariate volatility parameters are estimated. In stage two, for the time varying correlations matrix, residuals from first stage are used as inputs for estimation. For sake of brevity, we omit details of mathematical derivations and the equations which can be found in Pesaran and Pesaran (2009).

4.0 EMPIRICAL EVIDENCE

4.1 DESCRIPTIVE STATISTICS

The descriptive statistics for the daily returns of the 6 commodity spot price indices and DJ Islamic stock index, in our study provides interesting insights as represented by the standard deviations.

Table 2: Descriptive Statistics

	DJI	CM	EY	ML	AR	PM	ST
Mean	6.96E-05	0.000374	0.000284	0.000279	0.000372	0.000565	0.000315
Std. Dev.	0.011086	0.011149	0.020113	0.015753	0.012688	0.013486	0.013833
Skewness	-0.294426	-0.238584	-0.166490	-0.281619	-0.215939	-0.399456	-0.193535
Kurtosis	10.36142	5.398383	5.293964	6.500042	6.189263	8.432199	6.458300

The energy commodities (EY) seem to differ from other commodities in terms of volatility: the standard deviation (0.02) is much higher than the other commodity indices and even the DJ Islamic stock index. Together with high volatility, the group of energy and metal sector exhibits low returns on average, leading to the lowest benefit-risk trade off compared to the DJ Islamic and the other commodity indexes. However agriculture (AR), soft (ST) and precious Metal (ML) sector commodities are more profitable on the return-risk basis. However, DJ Islamic stock index is highly volatile as it has a significantly higher kurtosis value (10.36).

4.2 UNCONDITIONAL VOLATILITY AND UNCONDITIONAL CORRELATION

As a first step towards estimating dynamic conditional correlations and volatilities we first take a look at the summarized results of maximum likelihood estimates of λ1 and λ2 in the table 3. The table also summarizes the delta 1 and delta 2 estimates while comparing multivariate normal distribution with multivariate student t-distribution. From results it is evident that all estimates are highly significant implying gradual volatility decay for all indices. Also, if we analyze the sum of lambda 1 and lambda 2 values for different indices, we observe that their

summation is less than one, pointing that the indices are not following IGARCH; which means that shocks to the volatility is not permanent.

It is observed from the results that the maximized log-likelihood value for t-distribution 74857.3 is larger than the maximized log likelihood under normal distribution 73734.7. This implies that the student t-distribution is a more appropriate representation of the fat tailed nature of indices' returns. These findings are in agreement with findings of Pesaran & Pesaran (2009). To further substantiate this we observe the degrees of freedom which is 7.2941, well below the critical level of 30. Henceforth our analysis of the study works with the t-distribution estimates.

Table 3: Estimates of λ_1 and λ_2 and Delta

	Parameter	Normal Distribution		T - Distribution	
		Estimate	T Ratio	Estimate	T Ratio
Lambda 1	DJI	.91644	107.6226	.92470	107.5065
	CM	.97123	657.0932	.95881	498.0816
	EY	.96559	494.0573	.95502	393.7007
	ML	.96330	290.8348	.95444	267.4157
	AR	.97273	478.9770	.96461	398.2207
	PM	.97344	432.9338	.96358	268.3886
	ST	.96932	221.5354	.97131	195.7964
Lambda 2	DJI	.07182	10.6211	.06410	9.3985
	CM	.02852	22.3264	.03895	23.1890
	EY	.03348	18.9597	.04305	19.7601
	ML	.03366	12.6290	.03909	13.4955
	AR	.02631	16.0338	.03393	16.7875
	PM	.02610	13.9737	.03060	10.9886
	ST	.02667	8.4546	.02518	6.8059
Delta 1		.97617	1497.9	.98286	815.2008
Delta 2		.038114	25.5788	.037231	23.2575
Max. Log Likelihood		73734.7		74857.3	
Degrees of Freedom				7.2941	26.6005

Table 4 presents the unconditional correlation and volatility matrix for the 5 different DJ sector commodity spot indices, DJ main commodity spot index and DJ Islamic stock index, within our study helps us to further delve into the correlations between the indices and their

unconditional volatiles. The estimated unconditional volatilities are the diagonal elements highlight and in bold while off diagonal elements represent unconditional correlations.

Table 4: Estimated Unconditional Volatility & Correlation matrix for the indices

	DJI	CM	EY	ML	AR	PM	ST
DJI	.01108[7]	.42951	.29003	.43183	.31344	.18634	.28082
CM	.42951	.01116[6]	.83480	.62281	.68718	.49636	.50551
EY	.29003	.83480	.02009[1]	.30642	.34158	.26178	.27160
ML	.43183	.62281	.30642	.01577[2]	.35116	.38096	.30371
AR	.31344	.68718	.34158	.35116	.012723[5]	.31772	.64910
PM	.18634	.49636	.26178	.38096	.31772	.01353[4]	.28204
ST	.28082	.50551	.27160	.30371	.64910	.28204	.01384[3]

A perfunctory glance at the unconditional volatility numbers shows the highest volatility for the Energy sector index (EY) (also shown in the figure 4), as expected and is similar to our earlier observation in the descriptive statistics. Now this high volatility in the energy sector is from oil and gas. The crude oil prices during the past decades have shown a tremendous increase, translating into windfall gains for the oil companies, the movement of oil prices has been erratic. The main volatility in oil prices arises from the speculative trading as well as geo political issues. This erratic behavior and high volatility in oil prices, directly impacts the returns and stock values of the oil companies.

Figure 4: Conditional Volatilities
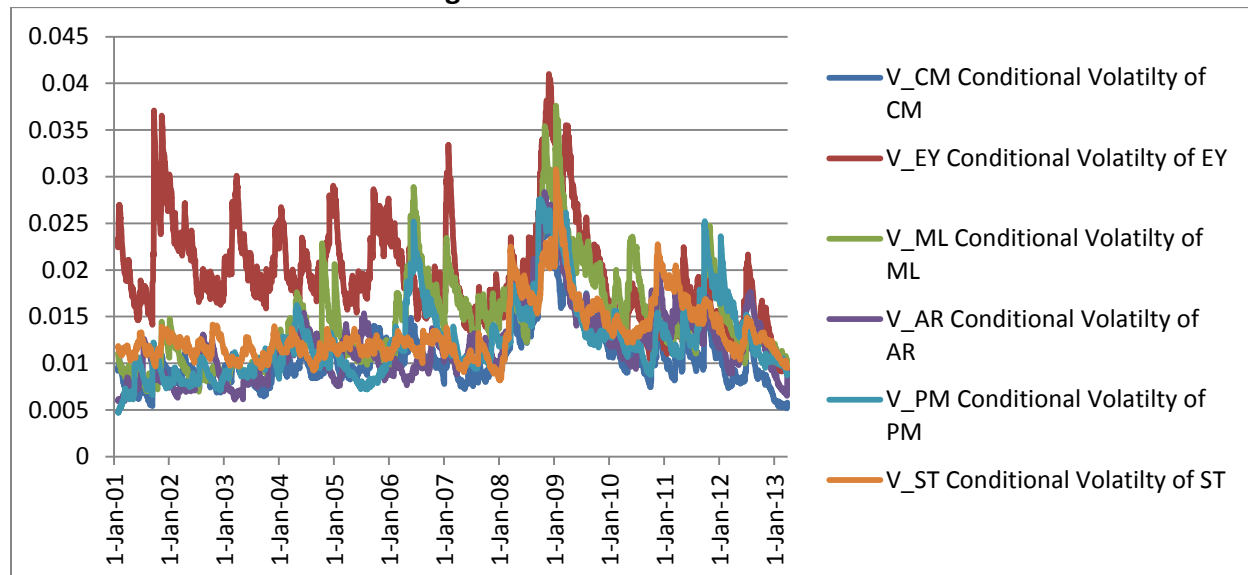
The second most volatile sector is metal (ML). The sharp increase in prices of metals is known to be driven by an upsurge in demand for these commodities from newly industrializing emerging economies, in particular, from the two most rapidly growing economies in the South - China and India - due to intensive use of these raw materials for their industrialization drive, physical infrastructure building and urbanization trends. However, a dramatic fall was reported for a number of metal prices such as nickel, zinc and copper due to immediate and impending reduction in world demand, notably, a drastic deterioration in global prospects for construction and automobile industries.

To assess the evolution of correlations between Islamic stock and commodity markets over time, figures 5 report the dynamic conditional correlations between each commodity sector and the DJ Islamic returns series. The links between markets during periods of financial stress are clearly underlined. The grey bands correspond to periods of bearish stock market, the white stripes corresponding to periods of bullish stock market. It shows that investment in Islamic equities constitutes an alternative to commodities, providing a mechanism for substitution between asset classes. Although there are some specific features for each sector of commodity market some common characteristics emerge.

Conditional Correlation between CM & DJI

Conditional Correlation between PM & DJI

Conditional Correlation between AR & DJI

Conditional Correlation between EY & DJI

Conditional Correlation between ML & DJI

Conditional Correlation between ST & DJI
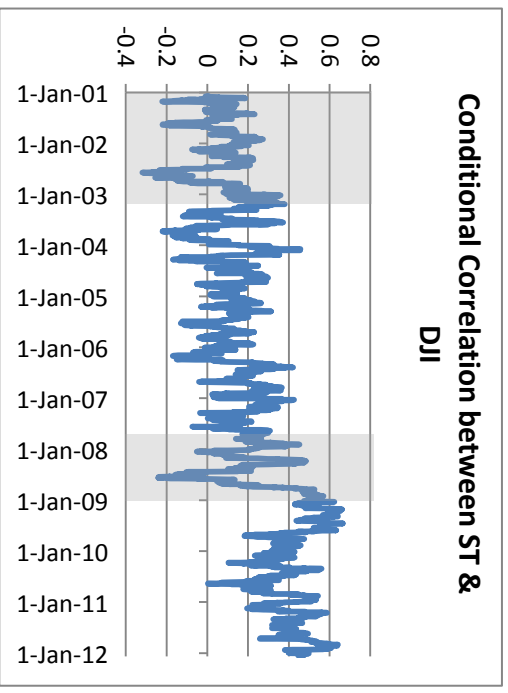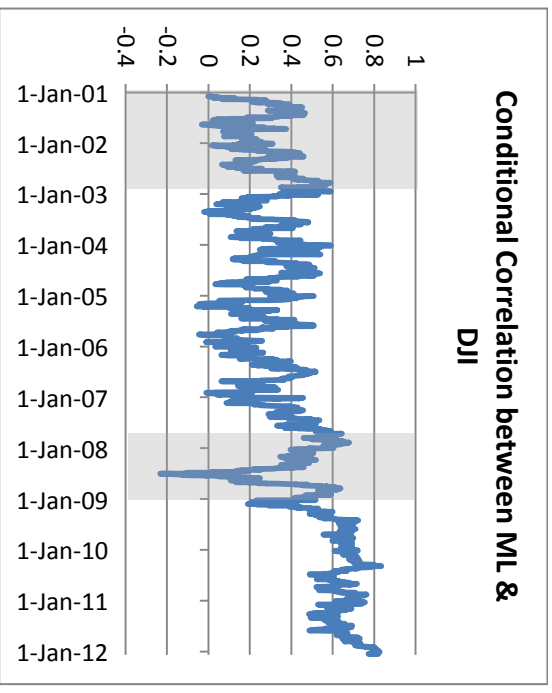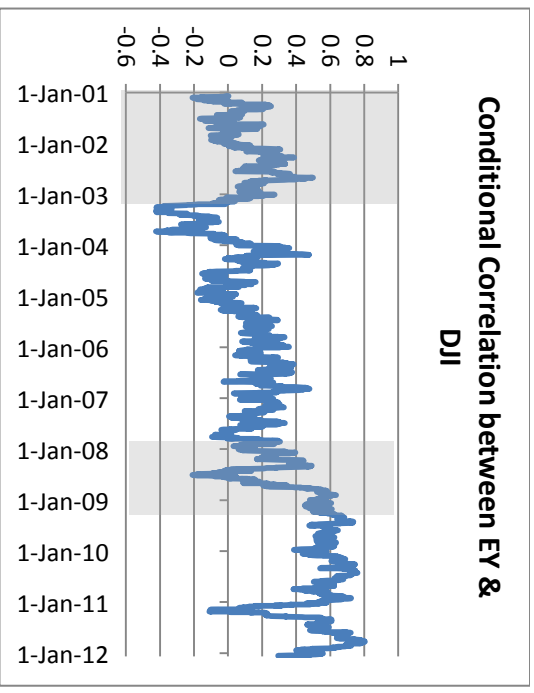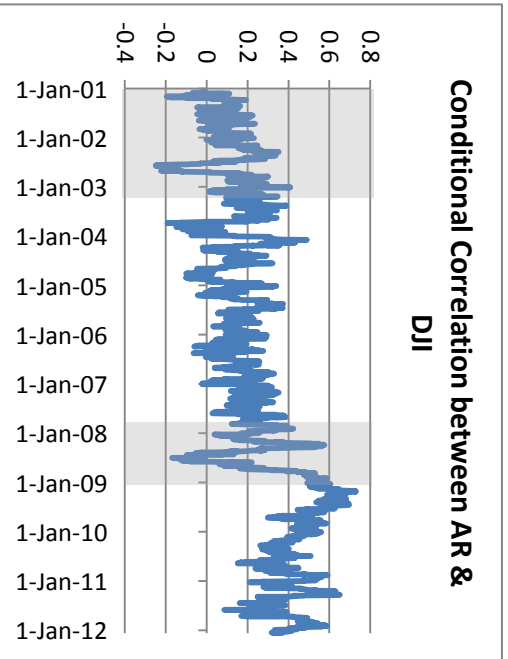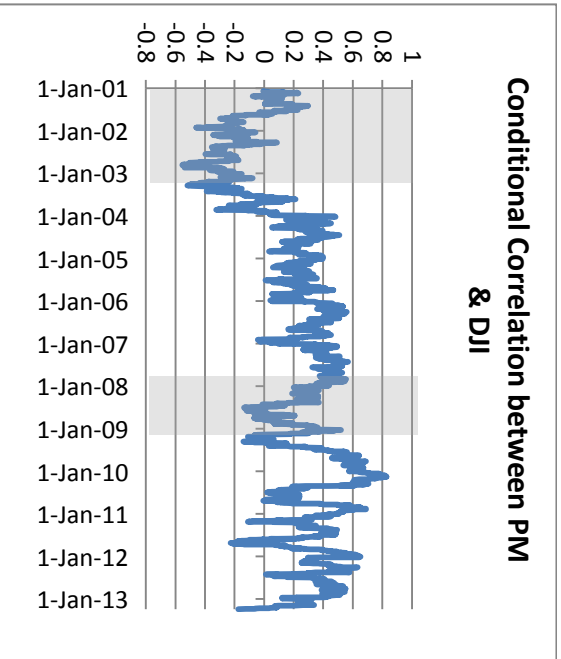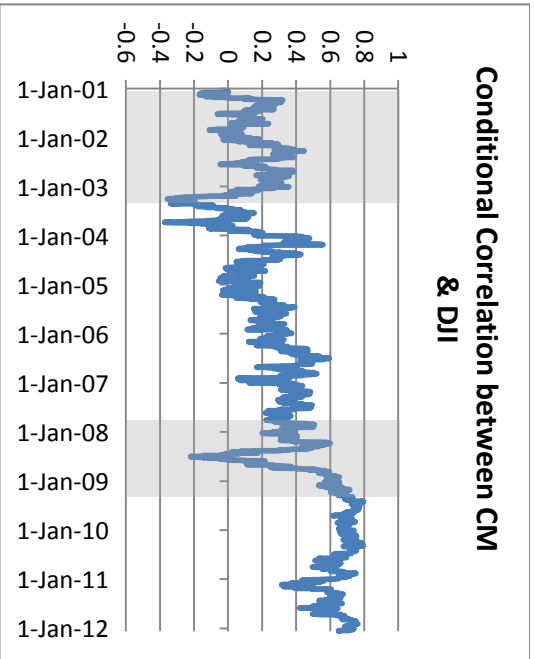
First, correlations are highly volatile throughout the period. For many raw materials, this volatility is particularly marked after the 2007-2008 financial crises. In all cases, there is an increase in volatility during and following the crisis. Second, in most cases, the largest drop in the correlations appears at the time of the 2008 financial crisis. The stock market collapse has loosened the conditional links between stock and commodity price returns, but only in the very short run. This decrease in correlations during times of high financial markets stress may be linked to a flight-to-quality phenomenon. When risk market rises, the benefits of diversification are most appreciated and investors tend to choose commodities as refuge instruments. This short-run characteristic could thus explain the temporary disrupted link between both markets.

Third, for almost all of the series, the highest correlations are observed after the crisis, at the end of the period under study. Both DJ Islamic stock index and commodity markets move upward during episodes of growing world demand for industrial commodities, giving an important role to commercial traders who use commodity futures to hedge their business activities. On the whole, the 2007-2008 financial crises has caused significant changes in the relationship between Islamic stock index and commodity markets, as well as increased correlation in the volatility. Regarding the long-run trends, correlations are likely to be governed by industrialization and financialization processes, as well as by commercial and non-commercial traders.

Let us now look more specifically at the different types of commodity sectors, starting by the energy group (EY), which consists of Oil, Gas and Electricity. First, Oil is clearly the most related to Islamic stock market. This predominance of oil may be due to the fact that it is one of the most important production factors. From a theoretical viewpoint, the fundamental value of any asset is given by its expected discounted cash flows. Consequently, an oil price increase will generate a rise in production costs, leading to restraining profits and, in turn, to reduction in shareholders' value. In times of rising stock prices, the correlations between stock and oil markets increase. During periods of declining stock prices, correlations tend to decrease and become negative during the 2007-2008 crises and 2011 debt-ceiling crisis, as shown in the correlation graph. This is also consistent with the well documented oil speculation

phenomenon, the increase in crude prices being prominent in times of rising stock market. From this perspective, oil cannot be seen as a means of portfolio diversification.

Turning to the precious metals group, which mainly includes; gold, platinum and silver, correlations are mostly negative and diminish in times of declining Islamic stock prices, highlighting adverse evolution in the markets. This is consistent with a safe-haven role of gold.

Regarding the other groups, two main findings can be highlighted: (i) volatility evolves over time, being quite stable before the 2007-2008 crisis, then getting stable till 2011 debt-ceiling crisis and becoming relatively high during the US debt-ceiling turmoil, and (ii) correlations tend to rise during the crisis, showing increased links between Islamic stock and commodity markets.

On the whole, our results show that the 2007-2008 crises have played a key role in the evolution of the links between Islamic capital and commodity markets. Indeed, higher correlations between both markets are generally observed during the financial turmoil, reflecting the phenomenon of financialization of commodity markets.

This phenomenon is particularly noticeable for energy sector including oil, a result which is consistent with the fact that oil is the most financiarized commodity. In addition, our findings show that raw materials cannot be aggregated in an homogeneous asset class: they are certainly influenced by common macroeconomic factors but also by their own market determinants.

5.0 CONCLUSION

This paper investigates the links between commodity and Islamic stock markets. We rely on the dynamic conditional correlation (DCC) GARCH methodology to establish whether the correlations between both markets evolve over time and depend on the situation—bearish or bullish—on the stock market.

The main findings can be summarized as follows. In the panel of 6 commodities sectors over the period from January 3, 2001 - March 28, 2013, first, the correlations between various

commodity sectors and DJ Islamic stock returns evolve through time, being highly volatile, particularly since the 2007-2008 financial crises. While the stock market collapse has loosened the links between both markets on the very short run, the highest correlations are observed during the financial turmoil, showing increased links between stock and commodity markets. Second, some commodities are characterized by a speculation phenomenon, especially oil in the energy sector, while their correlations with DJ Islamic returns grow in times of increasing stock prices, they diminish in times of bearish financial markets. Third, the safe-haven role of gold is evidenced, which constitutes a part of precious metal commodity. As the precious metal commodities correlations with DJ Islamic returns are mostly negative and diminish in times of declining stock prices. Fourth, while sharing some common features, commodities cannot be considered as an homogeneous asset class.

On the whole, our findings show that the 2007-2008 financial crises has played a key role, emphasizing the links between commodity and Islamic capital markets, and highlighting the financialization of commodity markets. This evolution in Islamic stock and commodity correlations reduces their potential substitutability in portfolios. At the idiosyncratic level, the main exceptions is gold for which risk management strategies are possible, with increased risk diversification allowed by their adverse evolution compared to the stock market in times of declining equity prices.

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