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Full length article

Commodity indexes and the stock markets of the GCC countries



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ABSTRACT

Much research is devoted to the study of the effect of oil on GCC markets. The link is evident, although waning. Little is known about the effect of other commodities, maybe because intuitively they are thought not to impact significantly these markets. However a finding of independence, or no-relation, has many implications for portfolio construction. Theoretically, if commodity markets respond to similar shocks as oil, which is a commodity itself, one would expect a positive relation. A negative relation is possible if commodities are diversifiers, or hedges, or even safe havens for GCC stock markets. The purpose of this study is to delineate empirically the nexus between GCC stock markets and commodity indexes. The results show that commodity indexes are in effect strong diversifiers and safe havens for GCC stock markets. One can improve the performance of a stock portfolio in GCC markets by including commodity indexes or, by extension, their derivatives. In other terms the risk/return trade-off is favourable to GCC investors. In fact the opportunity that is provided by the inclusion of commodities is puzzling: how come there is such an untapped opportunity, i.e. why didn't the GCC stock markets condense, absorb, and price this opportunity?

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1. Introduction

The six Gulf Cooperation Council (GCC) countries, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates, have by now become a centre for one of the most developed economies in the MENA and in the Middle Eastern region. Their reach is international, due mainly to the commerce of oil, which generates a substantial amount of funds that need to be invested.

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Therefore GCC countries have much interest in devising an optimal strategy for their investment portfolio. Portfolio considerations are different from economic ones. In this regard, if commodity indexes do not affect GCC stock markets, as expected, they have no economic role. However, it is by now known and clear that a portfolio of two independent assets benefits from the diversification of risk, making commodities similar to an insurance against adverse market fluctuations and shocks. Nonetheless, GCC countries are exerting much effort to diversify their economies, especially in the services sector, enhancing and investing in the business of finance, hospitality, health sciences, cultural festivities, sports events, university academia, marine and maritime activities, jewellery, fashion, real estate, and tourism.

Various studies have been done examining the relationship between oil prices and GCC stock markets throughout the years. Usually a non-linear direct relationship is found between oil prices and the GCC stock indices (Maghyereh & Al-Kandari, 2007). However, Mohalhal (2015) has found that the movement of GCC stock markets is not directly associated with the movement in oil prices, concluding that the three indirect factors affecting the GCC stock indices are market sentiment, international, regional, and domestic news and other factors, like political factors.

In parallel to this research, Wang, Lin, and Li (2013) have tested for the existence of the safe haven effect of international commodities (Rogers International Commodity Indexes) on equity prices in several markets. The results of the research showed that the safe haven effect was present for most regions/countries after the 2008 financial crisis. By safe haven is meant the existence of an asset uncorrelated or negatively correlated with another asset or portfolio during economic turmoil or market crises (Baur & Lucey, 2010).

Research in the last few decades did not consider that other commodities may also affect, either economically or financially, the GCC economies such as agricultural, precious and industrial metals. Additionally, the GCC countries possess developed financial systems and stock markets. This was necessary to attract foreign investment, not only in the energy sector but also in other vital industries. Oil may have been the primary factor affecting the economies of the GCC countries, but it is not the only one, especially during the last three years where oil has witnessed a significant plunge and lost around 70% of its value in just 7 months. Oil is not as crucial as it used to be for the GCC countries in generating reliable cash flows.

Our research will test whether international commodity prices have any statistically significant effect on the GCC stock market indices controlling for interest rates, and international and regional stock markets. Two main topics are of concern: 1) whether commodity prices act as a weak diversifier, a hedge (or strong diversifier), or a safe haven for these stock markets, and 2) whether the impact of commodity indexes is symmetric and linear in case of sharp positive or negative evolutions of these indexes. The paper departs from existing literature by introducing the concept of a weak diversifier, which is an asset that is positively but imperfectly correlated to the key variable. A hedge is considered to be a strong diversifier when its correlation with the key variable is nil or negative. This follows from standard portfolio management in standard corporate finance textbooks.

Our goal is to be able to advise policy makers, fund managers, portfolio managers, financial advisors and individual investors in the GCC area to better plan their portfolios, build their investment strategies, and hedge against stock market shocks by using various commodity indexes. As expected the results support the contention that commodity indexes do act as a hedge and as a safe haven in the GCC stock markets.

The paper is organized as follows. In the following section there is a perusal of the literature that is directly or indirectly related to GCC stock markets. In section 3 the definition and source of the data are given. In section 4 the empirical methodology and setup are described. In section 5 the empirical results are presented and discussed. The final section concludes.

2. Survey of the literature

The survey of the literature is divided into two parts. The first part elaborates on the relationship between international stock markets and commodity prices, whereas the second part studies the relationship between the GCC stock indices and oil prices. To our knowledge there is no study to date that dealt with the dynamics of the relation between commodity prices and GCC stock markets, despite the importance of this issue. This is where the paper has found a research niche by differentiating itself from the literature.

2.1. The relationship between international stock market indices and commodity prices

Johnson and Soenen (2009) test whether the stock markets of South American countries are affected by changes in commodity prices in the short run after controlling for changes in the currency exchange rates. The main hypothesis they test is whether there is no contemporaneous daily relationship between r_{it} (the equity return) and r_{it} (the Goldman Sachs commodity price index). The stock markets of Brazil, Argentina and Peru were found to have a statistically significant relationship with the various commodity price indexes at the 1% confidence level except for the industrial metals for Brazil and livestock for Peru. The stock market in Chili has a same day reaction to changes in the prices of energy, industrial and precious metals. The research has concluded that the stock markets of the South American countries have same day reactions to the commodity price indexes without lead-lag effects.

Rossi (2012) investigates the relationship between commodity prices and equity markets in the opposite way than the one intended in our research, testing whether equity prices can predict the commodity future prices in commodity-exporting countries. She finds that commodity prices are positively correlated with equity prices, global demand, and interest rates lagged one and two quarters. Furthermore, she conducts Granger causality analysis, (to forecast whether one time series is useful in predicting another, given the past history of the latter), to test whether the equity market growth has in-sample predictive content for the future global commodity price

indexes. The equity markets Granger cause future commodity prices in Australia, New Zealand, Canada, Chili and South Africa. There is strong predictive ability two quarters ahead in commodity prices for Australia, New Zealand and Canada only. However, for one quarter ahead there is no predictive ability for any of the five countries included in this research.

Zapata, Detre, and Hanabuchi (2012) found that agricultural commodities play a big role in a risk-averse investor's portfolio because they are less volatile in periods of market crises. They conducted their study by using monthly data of the S&P 500 index, PPI (Producer Pricing Index) and Commodity future contracts from the Chicago Mercantile Exchange (CME), through testing for correlation between the various commodities (food, farm, energy, metals, etc.) and the US stock market.

Heaton et al. (2011) propose a method for estimating the earliest time in the trading day when overnight information affects domestic share prices. One day lagged commodity prices do not affect the Australian stock market returns. There is some stickiness in the Australian Stock exchange opening price, in the sense that most of the reaction occurred after the market has opened, noting that the market's reaction and processing of the information happens within the first 15 minutes of the trading session.

Patel (2013) investigated the relationship between gold prices and three stock exchange indices in India using monthly time series data. Patel applies the Johansen cointegration methodology. The research has reached two conclusions: (1) there is a long run equilibrium relationship between gold prices and all the stock market indices as the Johansen's cointegration test reveals, and (2) The Granger causality test suggests that the gold price contains significant information to forecast the Indian stock market returns.

Wang et al. (2013) examined the relationship between Rogers International commodity index Agriculture, Energy and Metal, and various stock market indices for 12 countries/regions using the Morgan Stanley Capital International (MSCI) indices for Europe, the United States, Japan, Canada, Australia, China, India, Russia, Brazil, South Korea, Taiwan, and Africa. Two hypotheses were tested: (1) whether the commodities have a hedging effect on equity based portfolios, (2) whether commodities have a safe haven effect on equity based portfolios. A weak diversifier is an asset that is positively, but imperfectly, correlated with another asset. A hedge (or strong diversifier) is an asset uncorrelated or negatively correlated with another asset or portfolio on average. A safe haven is an asset uncorrelated or negatively correlated with another asset or portfolio during economic turmoil or market crises. Therefore, in contrast to standard and classic economic research hypotheses, our goal in this paper is to find insignificant or negative associations, and not a positive and significant association. Wang et al. (2013) used a model, initially introduced by Baur and Lucey (2010), to test the correlation between the commodities and the stock markets to determine whether commodities exhibit safe haven or hedging effects. Wang et al. divided the testing model into three different periods: low returns period, periods of high volatility, and periods of market crises. As for the hedging and safe haven effects, agricultural, metal, and energy commodities have exhibited safe haven effects for only few regions/countries' stock markets before the 2008 financial crises. However, these commodity indices exhibited the safe haven effect for most regions/countries' stock markets following the 2008 financial crises.

Mensi, Beljid, Boubaker, and Managi (2013) used a VAR-GARCH model to investigate the relationship and the volatility spillover between the commodity price indices and S&P500 using daily data from 3-Jan-2000 to 31-Dec-2011. They applied a VAR-GARCH model and tested for the correlation between the commodity indices and the stock market index. They test the null hypotheses of whether there is a predictive content in S&P500's past returns for its current returns, and whether the past S&P500's index has predictive content for the current commodity prices. The dynamic conditional correlation (DCC) between S&P500 and commodity indices is 0.0114 for Brent, and 0.0812 for gold. As per the estimates, a significant correlation and volatility transmission was found across commodity and equity markets. The results also showed the importance of adding commodities to an equity based portfolio to improve its risk-adjusted return.

2.2. The relationship between GCC stock market indices and oil prices

Maghyereh and Al-Kandari (2007) examine the non-linear relationship between oil prices and GCC stock market indices. The authors test the hypothesis that there is no cointegration between oil prices and GCC stock markets. The results show that the relationship between the oil price and the GCC stock indices is non-linear which is consistent with the findings of Mork (1989) and Hamilton (1996). Mork (1989) found that the increase in oil price is much more influential on the macroeconomic factors than its decrease. Hamilton (1996) found that the increase in the oil prices since 1986 is a correction to its previous fall.

Daly and Fayyad (2011) tested the relationship between oil prices and stock markets returns in several countries including Kuwait, Oman, Qatar, Bahrain, United Arab Emirates (UAE), UK and USA, using daily data. They apply the Vector Auto Regression (VAR) analysis to examine how the changes in oil prices will affect the stock markets in the GCC area and vice versa. Two hypotheses are tested: 1) oil prices can predict the stock market returns on a daily basis, 2) oil prices can be predicted by the stock market returns on a daily basis. The authors conclude that the results show that oil prices have a significant interrelationship with the developing markets like the GCC stock markets and developed ones like the USA and UK stock markets but to varying degrees.

Mohanty, Nandha, Turkistani, and Alaitani (2011) investigate the effects of the crude oil prices on the GCC stock markets prices. Their research concludes that the decrease in the oil prices has a negative impact on all the six GCC countries' stock market returns, whereas the increase in the oil prices has significant positive impact on only three GCC stock market returns out of six (UAE, Saudi Arabia and Oman), which indicates an asymmetric impact of oil price shocks on the equity markets of GCC countries. We will be testing for an asymmetric relation in the empirical part of this paper.

Aroui, Bellalah, and Nguyen (2011) and Aroui, Lahiani, and Nguyen (2011) use weekly data to capture the interactions between oil and stock prices in the GCC countries. The tests are intended for both the short and long term dependencies. Regarding the short term analysis, strong positive linkage has been found between the oil price changes and the stock markets for UAE, Qatar, and to some extent Saudi Arabia. As for the long term analysis, only the stock market in Bahrain has a positive relationship with the oil

price changes, whereas there is no evidence of any long term relationship between the oil price and the indexes of the remaining five GCC countries.

Azar and Basmajian (2013) also study the impact of oil prices and macroeconomic variables on two GCC stock market returns: Kuwait and Saudi Arabia. They used daily data starting from the 2008 financial crises until October of 2012. The research also included the Jordanian stock exchange index as an Arab non-oil exporting country and tested its linkage to Kuwait and Saudi Arabia stock index returns. They found that the S&P500 has a significant positive relationship with the stock markets of Kuwait and Saudi Arabia. The research also concludes that there is an asymmetric and nonlinear relationship between oil prices and GCC stock indexes.

Mohalhal (2015), already cited, found that the equity market returns in the GCC region do not associate exactly with oil price movements. These movements could be indirect due to economic fundamentals such as changes in market sentiment, news, and other factors e.g. political factor. He used daily data to conduct this research and used EGARCH by Nelson (1991) to investigate the heterogeneity of a sector's response in the stock market to the oil price changes and its volatility. The null hypotheses being tested are: there is no relationship between the lagged oil prices and different sectors within the different GCC stock markets.

3. Data definition and sources

The data that will be used in this research is of weekly frequency. The returns on the GCC stock market indices will be the dependent variables, whereas the percent change in the International commodity prices, the S&P500 index, the LIBOR rate, the Jordanian and Moroccan stock indexes will be the independent variables. The starting point of the time series will be January 1, 2005 and the end point will be February 28, 2017, the total number of weekly observations for each variable is 524. Initially, daily data was downloaded for all the variables and transferred into weekly where Tuesday's closing figure of each week was chosen. Later on, the data was adjusted to be a continuous time series (adjusted for holiday breaks) and, since the GCC countries stock markets are closed on Thursdays and Fridays, since Jordanian Market is closed on Fridays and Saturdays, since the Moroccan, the S&P 500 and the international commodity markets are closed on Saturdays and Sundays, leaving the research with three days that the markets have in common, which are Monday, Tuesday and Wednesday.

Although this paper intends to research the impact of international commodity prices on GCC stock indices, we cannot discard the other factors that also affect those indices. Hence, we have chosen the independent variables S&P500 and LIBOR to stand as a benchmark for the international stock markets and the international interest rates respectively, and test their effect on the regional GCC stock indexes. Moreover, we have chosen two regional countries' indexes as independent variables: The Jordanian and the Moroccan stock indexes. The Jordanian Stock Index is chosen because the country's economic and social structure remains the closest to the GCC countries' and it has the most developed stock market in the Middle East besides the GCC markets. The rationale behind choosing the Moroccan Stock Market as another regional independent variable is mainly because Morocco is also an Arab monarchy like most of the GCC countries and it was invited to join the council in 2011, making it a valuable regional independent variable that can have effect on the GCC stock indices. Although the inclusion of these two regional stock markets seems ad hoc, these markets can serve as propitious instrumental variables in the regressions. An instrumental variable is one that is correlated with the dependent variable but not with the regression residual.

The data used in this research are collected from online sources. TASI: Tadawul All Share Index, which is Saudi Arabia's all stock index and has 168 listed equities; DFMGI: Dubai Financial Market General Index, which has 33 listed equities; ADX: Abu Dhabi Securities Exchange General index which has 41 listed equities; KWSE: Kuwait Main Market Index which has 187 listed equities; BAX: Bahrain All Share Index which has 39 listed equities; MSM30: Muscat Stock Index, which includes the most liquid 30 stocks in the market; and QE: Qatar Stock Exchange General which has 20 listed equities.

The GCC stock indexes, The Jordanian stock index, the Moroccan stock index, and the S&P500 are collected from www.investing.com. The LIBOR is collected from ICE Benchmark Administration Limited (IBA). The commodity indexes are collected from their official website www.rogersmaterial.com. They are RIC: Rogers International Commodity Index, which is comprised of 37 commodities futures contracts, quoted in four different currencies, listed on nine exchanges in four countries, and each future contract has a different weight based on its market liquidity; RICIA: Rogers International Commodity Index Agriculture which is comprised of 21 different agricultural commodity future contracts; RICIE: Rogers International Commodity Index Energy which is comprised of 6 different energy commodity future contracts; RICIM: Rogers International Commodity Index Metals which is comprised of 10 different metal commodity future contracts.

4. The empirical setup

This research will perform many levels of tests to determine the significance of the relationship between the independent variables (international commodity prices, regional and international stock indices) and the dependent variables (GCC stock indices).

It is crucial to test for the stationarity of the time series, by testing for the existence of a unit root. It is common for macroeconomic variables to increase or decrease with mean, variance and correlation not remaining constant through time. Therefore, by conducting a unit root test, then differencing the time series, we will be getting better forecasting results and we will be minimizing the probability of having spurious regression results. The KPSS and the PP tests are used herein.

The results show that all the Log(variables) have a unit root when the PP test is conducted for levels. Log(KWSE) and Log(MSM 30) are the only variables that are stationary at 10% confidence level when the KPSS test is conducted at level.

After first differencing the time series, the PP tests show that all the variables become stationary at the 1% confidence level. Whereas, the KPSS test shows that most variables are stationary at the 1% confidence level and some are only stationary at 5% and 10% confidence levels. All the stationarity tests are available from the author.

We will test whether international commodity prices have safe haven or a hedging effect on the GCC stock markets by applying the model introduced by [Baur and Lucey \(2010\)](#) and [Ciner, Gurdgiev, and Lucey \(2013\)](#). The result of this test will show us the partial correlation between the variables and whether this partial correlation is positive, negative or insignificant during either normal circumstances or financial distress.

Two general dummy variables are generated. The first takes the value 1 if the log return of the commodity index is negative, and zero otherwise. Four such special dummies will be included interactively with the log return of each one of the four commodity indexes. The estimated regression coefficient on these 4 interactive variables will measure the symmetry effect, i.e. whether negative and positive log returns have the same impact. A statistically significant coefficient is evidence for non-linearity and asymmetry. For example, $RICIM| < 0$ is the interactive variable for the log returns of the commodity index RICIM for which a 1 is a negative outcome and a zero is a positive outcome.

The second general dummy takes the value 1 if the log return of the commodity index is less than 1.645 (or 1.96) standard deviations from the mean log return. This dummy corresponds to the 5% (or 2.5%) lower tail area, and should measure extreme negative movements like what happens in a financial turmoil or crisis. These dummies will enter interactively with the log return of the commodity index. Eight interactive dummies are defined, four for the case of the dummy at 1.645 standard deviations, and four for the case of the dummy at 1.96 standard deviations. A statistically significant coefficient, or a statistically insignificant coefficient, on each of these interactive dummies determines whether the respective commodity index is a safe haven or not. For example, $RICI|1.96$ is the interactive variable for the 2.5% lower tail area of the log return of the commodity index RICI, while $RICIE|1.645$ is the interactive variable for the 5% lower tail area of the log return of the commodity index RICIE.

The definition of this second dummy departs from [Baur and Lucey \(2010\)](#) and [Ciner et al. \(2013\)](#). We have used the standard normal distribution to specify the tail area, while the above authors have used quantiles (or percentiles).

The regression equation is of the following form, in which the time factor has been omitted for clarity purposes (R stands for log return):

$$R(\text{STOCK}) = \alpha + \sum_{i=1} \mu_i [R(\text{COM}_i)] + \sum_{i=1}^4 \beta_i [R(\text{COM}_i)| < 0] + \sum_{i=1} \gamma_i [R(\text{COM}_i)| | 1.645] \\ + \sum_{i=1}^4 \delta_i [R(\text{COM}_i)| | 1.96] + \theta_1 R(\text{SP500}) + \theta_2 R(\text{LIBOR}) + \theta_3 R(\text{MOROCCO}) + \theta_4 R(\text{JORDAN}) + \epsilon$$

The lagged dependent variable is sometimes added to the regression in order to account for serial correlation of the residuals. Our research questions are as follows:

- How do commodity price movements affect each of the GCC stock markets?
- Do commodities have hedging and/or safe haven effects on the GCC stock markets?
- Is the effect of commodities price movements on the GCC stock markets symmetric (linear) or asymmetric (non-linear)?

The definitions of the classes are as follows. An asset is a safe haven if it is not or is negatively correlated with the stock market in times of turmoil, or stress. Crisis is there for the impact of the 2.5% or the 5% lower-tail areas of the log return commodity index. An asset is a strong diversifier, or a hedge, if it is not correlated or is negatively correlated with the stock market log return. An asset is a weak diversifier if it is imperfectly and positively correlated with the log return of each stock market. The definition of a weak diversifier departs from the literature but is based on sound financial concepts of risk diversification. All variables are in first-differences of the natural logarithm, which, while called log return, is an approximate return figure that collapses to the true return as the frequency of sampling is higher. Log returns of weekly data are therefore close to their true percentage change counterparts.

4.1. The empirical results

This section portrays the results of the analysis for all the GCC countries stock indices, each one as a separate dependent variable, and the four Rogers Material Commodity Indexes, regional (JORDAN & MOROCCO) and international countries' stock indices (SP500), and interest rates (LIBOR) as independent variables. We estimated a GARCH model, and tested for the existence of auto-correlation and conditional heteroskedasticity. Using a GARCH model departs from the literature. However, if conditional heteroscedasticity is found in the data, and not accounted for, the standard errors, and the t-statistics, are invalid. Therefore our choice of a GARCH model should be considered as an improvement and not as a bad derogation.

At first, we aimed to eliminate the insignificant variables from the model. We did this by estimating each one of the seven models with all the independent variables included, and then by running a Wald test to check whether the eliminated variables are jointly insignificant. If not, we use the trial and error method trying to find all the significant variables and estimate the GARCH model for the second time with all the significant variables only included in the model. In rare cases, we had to include an insignificant variable, because the inclusion of that insignificant variable was a reason for one and more insignificant variables to have significant impact on the dependent variable. Afterwards, we tested for the existence of auto-correlation and conditional heteroscedasticity of the *standardized* residuals with 24 lags (or

Table 1 – Results for Saudi Arabia and Kuwait.

Kingdom of Saudi Arabia			Kuwait ^a		
Weak diversifier ($\rho > 0$)	Strong diversifier & hedge ($\rho \leq 0$)	Safe haven ($-1 < \rho \leq 0$)	Weak diversifier ($\rho > 0$)	Strong diversifier & hedge ($\rho \leq 0$)	Safe haven ($-1 < \rho \leq 0$)
RICI <0: 0.868111 (0.0410)	RICI: -1.537496 (0.3392)	RICIA 1.645: -0.366204 (0.3223)	SP500: 0.094121 (0.0213)	RICI: -1.723501 (0.0662)	RICIA 1.96: -0.414214 (0.0144)
RICIE: 0.121710 (0.0004)	MOROCCO: -0.009563 (0.9374)	RICI 1.96: -0.388929 (0.2564)	MOROCCO: 0.207949 (0.0002)	LIBOR: 0.094350 (0.7985)	RICIM 1.645: -0.300209 (0.0001)
JORDAN: 0.353763 (0.0014)	LIBOR: -0.037329 (0.2683)	RICIM 1.96: -0.094955 (0.6407)	JORDAN: 0.249607 (0.0000)	RICIM: 0.324060 (0.14454)	RICIE 1.96: -0.002079 (0.9817)
SP500: 0.407562 (0.0000)	RICIA: 0.478096 (0.3977)	RICIM 1.645: 0.009062 (0.9550)	RICIA: 0.593341 (0.0748)		RICIE 1.645: 0.073720 (0.4672)
	RICIM: 0.408941 (0.3340)	RICIE 1.96: 0.065890 (0.5417)	RICIE: 0.804490 (0.0408)		
		RICIE 1.645: 0.087955 (0.5255)			
		RICIA 1.96: 0.235641 (0.5056)			
		RICI 1.645: 0.454896 (0.2288)			

^a The symbol ρ stands for the partial coefficient. The regression includes the lagged dependent variable. So, all coefficients are impact, short run, coefficients. The coefficient on this lagged variable is 0.235507 with a p -value of (0.0000). Actual p -values are in parentheses.

weeks) for each GARCH model we estimated previously. If any of them had auto-correlation and conditional heteroscedasticity, we re-estimated the GARCH model with the inclusion of one extra independent variable which is the one-week lagged value of the same dependent variable that is being tested. The results are reproduced in Tables 1-4. The estimated coefficient ρ reported in those tables refers to the partial correlation coefficient on each variable from each of the seven regressions. There are seven regressions, instead of six, because the United Arab Emirates has two stock market exchanges. One is located in Abu Dhabi, and the other one in Dubai.

We shall evaluate the empirical results according to the independent variables. The US SP500 is a weak diversifier in all stock markets, except Bahrain, in which SP500 is a strong diversifier or a hedge. The Jordanian stock market is a weak diversifier in all 7 stock markets. The Moroccan stock market is a hedge in all stock markets except in Kuwait, and in Bahrain, where it is a weak diversifier.

In what concerns commodity indexes, RICI is a strong diversifier in all 7 stock markets; RICIA is a strong diversifier in Saudi Arabia, Bahrain, Dubai, Abu Dhabi, and Qatar, but a weak diversifier in Kuwait, and Oman; RICIE is a strong diversifier in Bahrain, Dubai, Abu Dhabi, and Qatar, and a weak diversifier in Saudi Arabia, Kuwait, and Oman; RICIA is a strong diversifier in Saudi Arabia, Bahrain, Dubai, Abu Dhabi, and Qatar, and a weak diversifier in Oman, and Kuwait; RICIM is a strong diversifier in Saudi Arabia, Kuwait, Bahrain, Dubai, Abu Dhabi, and Qatar, and a weak diversifier in Oman. By netting all impacts, all stock markets have the four commodity indexes as a strong diversifier, except Saudi Arabia, which has only three of them, excluding RICIE which is a weak diversifier, and Kuwait, which has two strong diversifiers (RICI and RICIM), and two weak diversifiers (RICIA and RICIE). From this behaviour of commodity indexes on stocks it is accurate enough to say that commodity indexes are most probably hedges in these seven stock exchanges. Moreover the reactions of the Dubai and Abu Dhabi stock markets are quite close to each other.

As for the characteristics of safe haven they are found in the reactions of the 7 stock markets commodity indexes. Saudi Arabia and Dubai stand alone in showing that the eight reactions to the commodity indexes in periods of turmoil, i.e. 1.645 and 1.96 standard deviations away from and to the left of the mean for the 4 commodity indexes, all satisfy the requirements of safe haven. Then the Oman stock market comes, with 7 impacts out of 8 that satisfy the requirements of safe haven. Bahrain comes next with six safe haven characteristics, excluding RICIA|1.645 and RCIA|1.96. Then comes the Abu Dhabi stock market with 6 reactions that conform to safe haven. Qatar has 5 "hits", and exclude notoriously RICIM (RICIM|1.645 and RICM|1.96). Finally Kuwait has only 4 "hits," that exclude RICIA and RICI in both turmoil situations. All this ascertains that commodity indexes act both as diversifiers, mostly strong diversifiers, and in majority are safe havens too. This finding should incite the Arab investor to include in her portfolio commodity indexes for the good and for the bad times. They provide for better risk management than regional stock markets like Jordan and, to a lesser extent, Morocco.

Table 2 – Results from Bahrain and Dubai.

Bahrain ^a			Dubai ^b		
Weak diversifier ($\rho > 0$)	Strong diversifier & hedge ($\rho \leq 0$)	Safe haven ($-1 < \rho \leq 0$)	Weak diversifier ($\rho > 0$)	Strong diversifier & hedge ($\rho \leq 0$)	Safe haven ($-1 < \rho \leq 0$)
MOROCCO: 0.111701 (0.0019))	RICI: -0.223043 (0.6913)	RICIM 1.96 -0.031629 (0.7533)	SP500: 0.381453 (0.0001)	RICI: -1.530756 (0.4617)	RICI 1.645: -0.650911 (0.0674)
JORDAN: 0.151560 (0.0003)	SP500: 0.023361 (0.5110)	RICI 1.96 -0.019339 (0.8999)	JORDAN: 0.489358 (0.0000) RICI <0:	RICIE <0: -0.456592 (0.0690)	RICIA 1.96: -0.378360 (0.0356)
RICI <0: 0.173599 (0.0001)	RICIE: 0.054459 (0.8156)	RICIE 1.96 0.018430 (0.7191)	0.501246 (0.0001)	MOROCCO: -0.086053 (0.2777)	RICIM 1.645: -0.131865 (0.5121)
	RICIA: 0.081473 (0.6954)	RICIE 1.645 0.040349 (0.4189)		LIBOR: -0.013334 (0.7714)	RICIE 1.645: 0.201230 (0.2094)
	RICIM: 0.100417 (0.4654)	RICI 1.645 0.079197 (0.6012)		RICIM: 0.267831 (0.5888)	RICI 1.96: 0.220658 (0.5049)
		RICIM 1.645 0.079919 (0.3889)		RICIA: 0.590330 (0.4402)	RICIE 1.96: 0.253651 (0.0732)
				RICIE: 0.679798 (0.4307)	RICIA 1.645: 0.211264 (0.3193)
					RICIM 1.96: 0.357060 (0.1194)

^a The regression includes the lagged dependent variable. So, all coefficients are impact, short run, coefficients. The coefficient on this lagged variable is 0.137802 with a p-value of (0.0025). Actual p-values are in parentheses.

^b The regression includes the lagged dependent variable. So, all coefficients are impact, short run, coefficients. The coefficient on this lagged variable is 0.106404 with a p-value of (0.0452). Actual p-values are in parentheses. The symbol ρ stands for the partial correlation coefficient.

Table 3 – Results for Abu Dhabi and Qatar.

Abu Dhabi ^a			Qatar		
Weak diversifier ($\rho > 0$)	Strong diversifier & hedge ($\rho \leq 0$)	Safe haven ($-1 < \rho \leq 0$)	Weak diversifier ($\rho > 0$)	Strong diversifier & hedge ($\rho \leq 0$)	Safe haven ($-1 < \rho \leq 0$)
SP500: 0.161710 (0.0010)	RICI: -0.593645 (0.2311)	RICI 1.645: -0.257154 (0.3624)	SP500: 0.296251 (0.0000)	RICI: -0.612511 (0.6785)	RICIA 1.96: -0.170482 (0.5408)
JORDAN: 0.308369 (0.0000)	LIBOR: -0.054528 (0.0962)	RICIM 1.645: -0.226835 (0.0519)	JORDAN: 0.452962 (0.0000)	RICIM <0: -0.377900 (0.0089)	RICIE 1.96: -0.075352 (0.4529)
	MOROCCO: 0.019984 (0.7182)	RICIA 1.96: -0.030685 (0.8564)		LIBOR: -0.029880 (0.3285)	RICI 1.645: -0.036497 (0.9025)
	RICIM: 0.149603 (0.6218)	RICIE 1.645: -0.020295 (0.8385)		MOROCCO: 0.078351 (0.2888)	RICI 1.96: 0.066853 (0.8347)
	RICIE: 0.184628 (0.7252)	RICI 1.96: -0.015986 (0.9521)		RICIA: 0.258549 (0.6185)	RICIA 1.645: 0.097173 (0.7095)
	RICIA: 0.266876 (0.5565)	RICIA 1.645: -0.014839 (0.9230)		RICIM: 0.286080 (0.3939)	
				RICIE: 0.346519 (0.5924)	

^a The regression includes the lagged dependent variable. So, all coefficients are impact, short run, coefficients. The coefficient on this lagged variable is 0.051516 with a p-value of (0.2701). Actual p-values are in parentheses. The symbol ρ stands for the partial correlation coefficient.

Table 4 – Results for Oman.

OMAN ^a		
Weak diversifier ($\rho > 0$)	Strong diversifier & hedge ($\rho \leq 0$)	Safe haven ($-1 < \rho \leq 0$)
SP500: 0.117158 (0.0070)	RICI: -2.242289 (0.0422)	RICIA 1.96: -0.139250 (0.3873)
JORDAN: 0.305519 (0.0000)	RICIM <0: -0.222754 (0.0209)	RICI 1.96: -0.172831 (0.5792)
RICIM: 0.643079 (0.0147)	MOROCCO: 0.031743 (0.5266)	RICI 1.645: -0.068408 (0.8211)
RICIA: 0.791634 (0.0402)		RICIM 1.645: -0.043570 (0.7216)
RICIE: 0.974322 (0.0355)		RICIA 1.645: 0.082540 (0.5120)
		RICIE 1.96: 0.084079 (0.4878)
		RICIM 1.96: 0.143893 (0.3523)

^a The regression includes the lagged dependent variable. So, all coefficients are impact, short run, coefficients. The coefficient on this lagged variable is 0.127017 with a p-value of (0.0093). Actual p-values are in parentheses. The symbol ρ stands for the partial correlation coefficient.

The tables have additional details. For example all impacts are classified according to the magnitude of the impact, from the most negative to the most positive. Moreover, symmetry tests are shown in the tables. For Saudi Arabia, $RICI < 0$ is positive and statistically significant. Hence negative changes in RICI impact the market more than positive changes. For Kuwait none of the four indexes shows any asymmetry. For Bahrain the impact of negative evolutions in the commodity index RICI is statistically significantly less than the impact of positive developments. For Dubai, $RICIE < 0$ is negative and statistically negative: negative changes in RICIE impact the stock market less than positive changes. Surprisingly negative changes in RICI impact the stock market of Dubai more than positive changes. For Qatar, $RICIM < 0$ shows the same differential impact but this time restricted to the RCIM commodity index. Oman shows the same reaction as Qatar. In both stock markets a positive change has a stronger effect than a negative one. There is no asymmetry evident in the Abu Dhabi stock market.

In general the results are consistent with expectations. It is acceptable to find that commodity indexes are little correlated with the GCC stock markets, because commercially they have no use for commodities other than oil, and it is expected that after the international meltdown the safe haven property became apparent in the data.

5. Conclusion and recommendations

The log returns of the International commodity price indices were found to act as diversifiers and as safe havens for the GCC log returns. Based on these findings, and in accordance with our prior guess about the effect of commodity prices on the GCC stock markets, we will be providing our recommendations hereafter.

If you are an investor in the stock markets of the GCC countries, it is strongly recommended to use commodity based financial instruments (Future contracts, ETFs, Index funds, etc.) to hedge against market volatility during normal circumstances.

If you are an investor in the stock markets of the GCC countries, and you want to protect your portfolio's value during financial crisis, using commodity indexes based financial instruments as safe-haven should provide that protection.

In general the stock markets of the GCC countries do not show strong evidence of non-linearity. And when there is non-linearity the effect of negative values can paradoxically be either higher or lower than the effect of positive values.

If GCC investors follow the above strategy it is likely that commodity prices will be bid up, thereby eliminating partially or fully their hedging and safe haven properties.

As for future research, I recommend that portfolio theory researchers in the GCC region to use our findings as a foundation to reach the optimum portfolio, that generates the highest returns, which is also a hedge against market volatility and protected during financial crisis. In this regard the precepts of Markowitz diversification are useful.

The main limitation of this research is the measurement of the political factor (regional and domestic) and its effect on the stock markets of the GCC countries. The political factor here could be the result of military or political tension, or could be the result of

internal policy changes that could affect the stock market of certain GCC countries. The uprising in Bahrain that started in February 2011 is a major political factor.

Another major political factor is the war between Yemen and the coalition of the GCC countries. Iraq which has borders with Kuwait and Saudi Arabia is in a war state since 2003. There is continuous tension in the Gulf region between Iran and most of the GCC countries. It is very difficult to measure the impact of the above factors on the GCC stock markets, and perform quantitative analysis on them, similar to the ones performed in the empirical part of this thesis.

Conflict of interest

None declared.

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