Risk return profiles of Islamic equities and commodity portfolios in different market conditions

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Abstract

Motivated by the recent phenomenal growth in Islamic finance and the financialization of commodities, this study makes an initial attempt to investigate the risk-return profiles of optimized portfolios combining (a) Islamic equities with commodities and (b) conventional equities with commodities during the crises and non-crises periods. The findings tend to indicate that Islamic equity-commodity portfolios provide relatively higher diversification benefits than the conventional equity-commodity portfolios during the 1997 Asian Financial Crisis triggered by the financial sector compared to the 2008 global financial crisis triggered by the real housing sector. The findings further suggest that except for a few cases, commodities in general and gold in particular improve diversification benefits.

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1. Introduction: motivating the study

The main objective of the paper is to investigate the risk-return profiles of optimized portfolios combining (a) conventional equities (b) Islamic equities (c) Islamic equities with commodities and (d) conventional equities with commodities during the crises and non-crises periods. Even though a few studies have addressed the issue of portfolio diversification and optimization in the conventional financial markets in their studies (Boubaker and Sghaier, 2013; Eiling et al, 2012; Belousova and Dorfleitner, 2012; Utz et al, 2014; Cumming et al, 2013; Behr et al, 2013; You and Daigler, 2013; Becker et al, 2013), there is hardly any study that addressed the questions: how did the correlation change over time between equity returns (both Islamic and conventional) and commodity returns? How did this correlation behave during the crises and non-crises periods? Are there any additional benefits for the investors if they include Islamic equities and commodities in their investment portfolios during the crises and non-crises conditions? What would be the optimum size of investment in equities and commodities during the same periods? We

attempt to address these questions with the help of some recent but appropriate methodologies.

The objective of the study is significant since global investors have been experiencing severe losses over the decades during the financial crisis. In order to mitigate losses, investors started including alternative assets such as, real estate and major commodities in their portfolios. Investment in Islamic financial instruments has increased over the years and particularly during the 2008 financial crisis, when this industry got maximum momentum. Islamic finance industry, equipped with financial instruments of capital market, money market, banking and insurance industries, has proliferated rapidly during the 2008 Global subprime crisis in particular. Market value of Islamic financial assets reached around $1.6 trillion in 2013 observing a high growth rate of 500% (Hammoudeh et al., 2013) from $1.46 in 2012. This rapid growth induced several governments and policy makers in a number of developed and developing economies to identify Islamic financial industry as a key area of investments. The most notable support for Islamic finance investments came from the address by the president of the World Bank at the 5th Izmir Economic Congress held in 2013[*]. In addition, in the same year, the British prime minister announced the plan of starting a new Islamic Index in London Stock Exchange. Furthermore, proponents of Islamic finance industry and Islamic scholars claim that Islamic equity based financial instruments would be relatively safer investment for the investors due to the unique features of Islamic financial instruments such as, low leverage ratio and genuine asset backing.

Why is it important for the portfolio managers to include Islamic equities in their portfolios? In principle, all Islamic financial instruments are asset-based and asset-driven prohibiting dealing with interest. Moreover, Islamic equities must pass through qualitative and quantitative screening processes. On the contrary, mainstream equities and financial instruments do not have such restrictions and bindings. Because of this divergence, it would be valuable and interesting to investigate whether there is any additional benefit for the investors from their optimized portfolios consisting of Islamic and conventional equities

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[*] 5th Izmir Economic Congress was held between 30 October and 1 November 2013. The main theme of the Congress was "Turkish Economy in the light of the Global Economic Restructuring".

and major commodities. In addition to the basic principles, Islamic financial institutions must avoid dealing with some non-ethical sectors such as liquor, pornography, pork, etc. The Islamic financial system was established to take into consideration these principles on top of the religious aspects, moral, ethical, and social dimensions (El Khamlichi et al., 2014). It was also deemed to be more stable than the conventional system especially during the crisis periods (Arouri et al., 2013). Due to the prohibition of interest, the need for equity markets is higher in Islamic finance (Iqbal, 2002).

Theoretically, it can be argued that Islamic equities are likely to be less risky than their conventional counterpart due to lower leverage ratio and consequently the risk-return profile of Islamic equities is likely to be different compared to that of conventional equities. Lower leverage in the capital structure, indeed, reduces the probability of defaults of fixed interest payment by the firms and thereby the riskiness of the firms. Consequently, the existence of lower leverage in a firms' capital structure tends to minimize the chances of default and bankruptcy in general. However, a stock, in order to be Shariah compliant, must pass through a quantitative and qualitative screening. This screening process curbs the asset universe of Islamic indexes and hence the opportunity for enhanced diversification becomes questionable. Furthermore, the screening process is not cost free, which again curbs the benefits of portfolio diversification by Islamic equities. Therefore, from a theoretical viewpoint, the issue of achieving additional diversification benefits from portfolios consisting of Islamic equities still remains inconclusive and unresolved.

Moreover, it is generally perceived that particularly in a financial crisis period, a portfolio which includes Islamic assets would perform better in terms of diversification compared to a portfolio consisting of only the conventional assets. This is generally expected due to the lower leverage ratio and the rigorous qualitative and quantitative screening that the Islamic equities have to pass through. But have the Islamic equities indeed performed better than the conventional equities in all financial crises ? This interesting question has never been asked before. In this study, during the period under review, we had two major financial crises: the 1997 Asian financial crisis and the 2008 global financial crisis. It is therefore very pertinent to investigate whether in terms of

portfolio diversification, the Islamic equities did indeed perform better than the conventional equities during both these financial crises.

These unresolved questions mentioned above as to whether, compared to the conventional equities, an inclusion in general of Islamic equities in a portfolio is better or not and in particular during a financial crisis motivated us to investigate the issues empirically. Findings of the empirical results tend to indicate that there are generally no additional diversification benefits by forming portfolios combining commodities and Islamic equities compared to the portfolios combining commodities and mainstream equities. However, Islamic equity-commodity portfolios offer relatively superior diversification benefits (compared to the conventional equity-commodity portfolios) during the 1997 Asian Financial Crisis than during the 2008 global financial crisis. This is a very interesting finding which is plausible and intuitive since the financial sectors triggering the 1997 Asian financial crisis are excluded from the Islamic equities, whereas the real housing sector triggering the global financial crisis is not excluded from the Islamic equities.

In order to address the issue of the study, we apply dynamic conditional correlation (MGARCH-DCC) to measure the changes in correlation between returns of equities (Islamic and conventional) and commodities in bull and bear market conditions. Finally, we simulate portfolios using equity and commodity returns applying Markowitz Portfolio Model (MPM) in order to investigate risk-return profiles and diversification benefits of the concerned portfolios.

Our contribution to the literature is five-fold. *Firstly*, we document the risk return profiles of portfolios combining equities (Islamic and conventional) and commodities in different market conditions (crisis and non-crisis periods). *Secondly*, unlike other studies, we tested dynamic relationship between the equity (Islamic and conventional) and commodity returns in order to form portfolios during crisis and non-crisis periods. *Thirdly*, we investigated return performance (Risk adjusted and unadjusted) of the optimized portfolios and thereby we determined the optimal investment in different assets. *Fourthly*, we evidence the superior performance of Islamic equities during the financial crisis which is

mainly triggered by the financial sectors. *Finally*, we applied two most appropriate recent methods on a comprehensive data set in order to address the research questions.

We have several findings in our study. *Firstly*, we evidence that the Islamic equities, on an average, performed better than the conventional equity during the 1997 Asian financial crisis. On the contrary, conventional equities performed better than the Islamic equities during the 2008 global financial crisis. *Secondly*, we find that correlation between equity (Islamic and conventional) and commodity indexes has increased during the financial crises, with the exception of gold. This increased correlation would contribute to declining portfolio diversification benefits of the portfolios of commodities and equities. *Thirdly*, we claim that other commodities such as cocoa and crude palm oil played a significant role in portfolio diversification mostly during 1996 – 2003, when commodity prices increased in a downward equity markets mostly in Asia due to the 1997 Asian Financial crisis. *Fourthly*, we unveil that Islamic equity-commodity portfolios provide higher diversification benefits than the conventional equity-commodity portfolios during the 1997 Asian financial crisis compared to the 2008 global financial crisis. *Finally*, we identify that most commodities in general and gold in particular produce higher diversification benefits for the equity investors during the periods under review.

Rest of the study is organized as follows. Section two presents a brief summary of the recent literature and section three describes the data and methodology and section four reports results and empirical analysis of the study. Finally, the study wraps up with concluding remarks in section five.

2. Literature Review

Empirically a few studies have investigated the issue of portfolio optimization in conventional financial market. However, hardly there is any study that examined the risk return profiles of optimized portfolios combining Islamic and conventional equities and commodities. Study by Utz et. al (2014) compute the implied risk tolerances of socially responsible funds that pursue an additional objective beyond risk and return. The study finds no significant evidence that social responsibility issues, after the screening stage, are

further taken into account in the asset allocation process, which is a result that is likely to be different from what many socially responsible investors would expect. However, Cumming et. al (2013) show that none of these indices is fully suitable for portfolio optimization and they introduce a new benchmark index for venture capital and buyouts, which is updated monthly, adjusted for autocorrelation (de-smoothing), and available contemporaneously. Conversely, Xidonas and Mavrotas (2014), developing a multi-objective portfolio optimization framework, find a sufficient number of efficient portfolios produced by the prescribed framework outperformed the benchmark. Another recent study by Behr et. al, (2013) develop a constrained minimum-variance portfolio strategy on a shrinkage theory based framework. Results of the study show that the constrained minimum-variance portfolio yields significantly lower out-of-sample variances than many established minimum-variance portfolio strategies. Using individual future contracts, You and Daigler (2013) show that ex-ante complete futures portfolio dominates the traditional and naive portfolios and the ex-post portfolio outperforms the naïve portfolio. Furthermore, regarding the dependence structure exist between returns on equity and commodity futures, Delatte and Lopez (2013) find three major stylized facts: (i) the dependence between commodity and stock markets is time-varying, symmetrical and occurs most of the time (as opposed to mostly during extreme events), (ii) restricting for time-varying parameters in the dependence distribution generates a bias towards an evidence of tail dependence and (iii) a growing co-movement between industrial metals and equity markets is identified as early as 2003 which spreads to all commodity classes and becomes unambiguously stronger with the global financial crisis after Fall 2008. Nevertheless, Boubaker and Sghaier (2013) articulate that the presence of long memory affects both the dependence structure between financial returns and the efficient frontier. Additionally, Jacobs et al (2014) show that a very broad range of heuristic asset allocation schemes offers identical diversification gains as recently developed portfolio optimization models in both international stock market and market for other alternative assets.

A few other studies address the dynamics of international portfolio diversification in both equity and alternative asset markets. For instance, Eiling et al (2012) investigate the importance of industry, country, currency risk, and world market for international portfolio

diversification. The study finds the main determinants of equity returns are global industry and currency risk factors when expected returns, volatility and currency risks are allowed to vary overtime. Moreover, Daskalaki and Skiadopoulos (2011) find that commodities are beneficial only to non-mean-variance investors and these benefits are not preserved out-of-sample. Findings of the study challenge the assumed diversification benefits of commodities. However, commodities provide diversification benefits in a real sense only during the 2005–2008, an exceptional commodity boom period. Likewise, using a non-public dataset of trader positions in 17 U.S. commodity future markets, Büyükşahin and Robe (2014) show that the correlation between the rates of return on investible commodity and equity indices jumped through greater participation by speculators in general and hedge funds in particular. Alternatively, Christoffersen et al (2012) show that correlations have amplified remarkably in both developed and emerging markets, but they are higher in developed than emerging markets. Consequently, benefits from international diversification have dropped significantly in developed markets while, emerging markets still offer diversification benefits particularly in severe market downturns.

A few recent studies address the issues of risk-return relationship and portfolio diversification of Islamic investments. For example, Abbes & Trichilli (2015) show that Islamic stocks could offer potential diversification benefits by considering different economic grouping such as that in developed and emerging countries. The findings of this study are in line with the almost similar findings in Saiti et al (2014) and Wahyudi & Sani (2014). Ajmi et al (2014) however supports the recoupling of the Islamic equity markets with their conventional counterparts and consequently, reduces portfolio diversification benefits. Moreover, Ashraf and Mohammad (2014), applying a logistic smooth transition autoregressive (LSTAR) model, show that Islamic equity investments, in general, performed superior than conventional equity investments during 2000 -2012. Further, the study finds evidence that Islamic equity investments generate positive abnormal return from Europe and Asia. Similarly, Rubio et al. (2012) investigate a risk-return relationship for Islamic funds, International funds, and American funds employing Data Envelopment Analysis (DEA) in order to explain which set of assets has the best performance. The results of the study are in line with the findings of the prior studies, which suggest that Islamic funds are

highly efficient and that they outperform their international counterparts particularly in the 2008 Global financial crisis. However, Kamil et al (2014) show that Islamic equity funds do not outperform market benchmarks in Malaysia. Moreover, positive abnormal return in Islamic equity investment is more luck dependent than the fund managers' skills. Likewise, Hayat and Kraeussl (2011) find average underperformance of Islamic equity funds (IEFs) as compared to the Islamic and conventional benchmarks, even before considering management fees. This underperformance of IEFs has accentuated, particularly during the episode of 2008-2009 global financial crisis, which is contradictory with the findings of the previous research by Abdullah et al. (2007) indicating that IEFs perform better during the bear than bull markets. Using both parametric and non-parametric techniques to test market timing of the IEF managers, the study finds that IEF managers are poor market timers. Going further, the study analyzes downside risk as a potential explanation for the inferior performance but found that IEFs do not possess any significant downside risk. Similarly, the overall findings by Djennas (2016) show that two economies, one with Islamic financial industry and another with conventional financial industry, perform almost identically. However, economies adopting Islamic financial industry perform better than conventional counterparts during the financial crises and economic downturns when considering some specific components of the financial stress index. Correspondingly, Derigs and Marzban (2009) argue that different Shariah scholars from different schools of thought differ in their opinion regarding the qualitative and quantitative screening process, which leads to significant differences with respect to Shariah compliance. Analyzing the discrepancies, the study proposes several new approaches to apply the various rule systems and a new standard for defining Shariah-compliance. Another study by Alam et al (2013) finds that the market reaction is negative for the announcements of Sukuk before and during 2007 global financial crisis. On the other hand, market reaction is positive for announcement of conventional bond before the crisis period and negative during and after crisis periods. The size of bond offering appears to have a negative impact on the cumulative abnormal return in case of Sukuk and positive in case of conventional bond.

Conflicting and inconclusive findings of the existing studies identify a knowledge gap in investigating risk return profiles and portfolio optimization of Islamic equities, conventional equities and commodities. We attempt to fill in this gap in this study.

3. Data Description and Methodology

3.1 Data Description

This study uses equity (Dow Jones Conventional and Islamic equity indices of U.S.A., Canada, U.K., Japan, Malaysia, Turkey, and GCC) and commodity (S&P GSCI indices of cocoa, crude palm oil, crude oil, gas and gold) returns collected from Datastream and Bloomberg data bases. While the study period covers a period of seventeen years since January 01, 1996 for our empirical analysis, Dow Jones Islamic equity indices of GCC and Turkey are available since January 2004. Hence, the study uses these two equity returns since January 2004. Major Muslim countries produce these commodities and hence, this study uses these commodities[†]. Besides, increasing price of these commodities in general and price of gold in particular attracts supply of investment in commodities. As for the equity indices, the study uses equity indices from the above markets because they are the major producers, exporters and importers of the commodities under consideration. In addition, Dow Jones provides both conventional and Islamic indices for these markets since 1990s. Further, the study uses the US 3- month T-bill rate (as a proxy for risk free rate) and S&P Global BMI index (as proxy for market portfolio) for portfolio optimization purpose. "The S&P Global BMI (Broad Market Index), consisting of the S&P Developed BMI and S&P Emerging BMI, is a comprehensive, rules-based index measuring global stock market performance. The S&P Global BMI represents the only global index suite with a transparent, modular structure that has been fully float-adjusted since 1989[‡]."

The study period is divided into two major sub-periods (1997 and 2008) in order to take two major financial crises: (a) 1997 Asian Financial Crisis and (b) 2008 Global Financial Crisis into account. Further, the study divides each sub-period into three more episodes (sub-periods) for intensive analysis based on the information regarding major crises dates

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[†] www.data.un.org
[‡] S&P Global BMI factsheet

used in the earlier studies (e.g. Phillips & Yu, 2011; Claessens et.al, 2010; Guillén, 2009). These episodes are presented in table 1:

In addition, owing to the operating time differences among the stock markets, we made required time adjustment following Universal Co-ordinated Time (UTC – 6.00 Hours) in order to maintain time homogeneity in data, which depicts the picture more accurately. Following table 2 reports the data with short description:

3.2 Overview of equity and commodity markets

3.2.1 Equity prices

This study selects equity indices (both Islamic and conventional) from both developed and emerging markets. Data shows that both Islamic and conventional equity prices in Malaysia drops severely in the middle of 1998 as a consequence of 1997 Asian financial crisis. Malaysian equity market then turns around and plunges again during 2008 Global financial crisis. However, in addition to 1998 and 2008 financial crises, Japanese equity prices plummets again in April 2003 owing to the asset price bubble bust, almost after more than a decade, when real estate and stock prices inflated greatly in Japan because of this asset price bubble. However, other equity markets under consideration are not the major victims of 1997 Asian financial crisis. GCC equity markets for example, nose-dived in the first quarter of 2008, in the wake of the 2008 global financial crisis, which engulfed all of the local stock markets in GCC and led to major decline in valuations as compared to what it had been in the mid-2000s. Particularly Islamic equity prices in GCC markets severely decline in 2009 due to the Dubai sovereign debt crisis that begins with the debt (sukuk) default of state-owned Dubai world in November 2009. This crisis was a consequence of highly leveraged local and international investments by mostly state-owned companies. Whereas, both Islamic and conventional equity markets in Turkey are affected by the 2008 Global financial crisis.

Likewise, both mainstream and Islamic equity markets in the U.K. drops in the first and second quarter of 2009 owing to the 2008 global financial crisis. Prior to Global financial crisis, stock markets in the U.K. stumble in early 1999 and in the first quarter of 2003 before crashing in 2008. This downturn can be viewed as part of a larger bear market

11

or correction that began in 2000, according to a report by the Cleveland Federal Reserve.§ Collapse of Enron is a prime example. Enron scandal, the internet bubble busting and September 11 attacks altogether contribute to the slumbering stock market in the U.S.A., the U.K. and Canada prior to the final crash in 2008 caused by the Global financial crisis. Apparently, most of the developed equity markets in the U.K., the U.S.A and Canada are not the major victim of 1997 Asian financial crisis, which mostly hits major East Asian equity markets.

3.2.2 Commodity prices

While prices of all commodities under review swings with an upward trend when there is a downturn in equity markets, gold prices jumped from the first quarter of 2001 and reaches at its maximum in September 2011. A number of factors such as increasing balance of trade deficit in the United States, low output of gold, sovereign debt crisis in Greece, Spain and Ireland, increase in gold reserve by the Reserve Bank of India (357.75 tons in 2009) and People Bank of China (1054 tons in 2009), volatile equity markets, sharp fall in deposit interest rates in the global market etc. trigger gold price to rise.

Cocoa prices drops to its lowest level in the last quarter of 1999, the year when there was an oversupply due to lower demand of cocoa in the global market. Continued economic downturn in the Russian Federation, Eastern Europe, Brazil and the Far East contribute to the downward price pressure of Cocoa. For example, cocoa price drops to the lowest level of the season, $1,202/ton during the last quarter of 1999.** Afterwards, cocoa price starts to rise till 2003 before the next drop. Cocoa price further jumps to its record level in the first quarter of 2011 due to the supply disruption by the major producers such as Ghana, and Cote d'Ivoire, caused by political instability.†† Particularly, cocoa export ban in Cote d'Ivoire (endorsed by the Obama administration) triggers global cocoa price to hit $3,775 plus per ton in March 2011, which is the record price in the last 32 years.‡‡

The price of crude Palm oil (CPO) starts to decline in the third quarter of 1998 and reaches at its lowest level in the second quarter of 2001. The CPO price again starts to rise

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§ "A Retrospective on the Stock Market in 2000"
** Page 28, Commodity Market Review 1999 - 2000
†† Page 179, Global Economic Prospects 2003
‡‡ Page 45, Cote d'Ivoire Post Election Crisis

and jumps to its peak in the first quarter of 2008 followed by another price drop in the third quarter of 2008. The CPO price further increased in the last quarter of 2010. The shortage of global supply of CPO contributes to a sharp increase in Malaysian CPO export price in 1997 and 1998 when exports of the commodities increased by 14.6% and 64.4% respectively in Malaysia. Hence, CPO becomes the single largest export earners in commodities market of Malaysia.[§§] Afterwards, palm oil prices increased by almost 44% from 2007 to 2008 and then declined sharply till the last quarter of 2008. The weakening of edible oil prices reflects not only slower economic growth but also increased supplies, and perhaps mounting pressure in the European Union (EU) to scale back biofuel mandates – most of the EU's biofuel production is biodiesel, whose raw material is rapeseed oil, a close substitutes for palm and soy bean oils.[***]

The price of crude oil was the lowest in the last quarter of 1998 and increases afterwards amid smaller swings and reaches at its peak in the third quarter of 2008 before the next plunge in the last quarter of 2008. Since then crude oil price continued to soar till the first quarter of 2012. The crude oil price dynamics reveals the underlying fundamentals of crude oil markets.[†††] World crude oil supply was limited at about 81 million barrels per day (mbd) during 2002 – 2006 in spite of rising prices. During the same period, world crude oil demand, however, heavily influenced by a few factors such as the world economic growth rate, which was about 4 – 5% per annum, excessively low nominal interest rates, and sharp depreciation of US dollar etc.[‡‡‡] In addition, Askari and Krichene (2007 a, b) addressed that world crude oil demand is known to be highly price inelastic in the short term. In other words, significant increase in oil price would have only a small negative impact on oil demand. Moreover, world crude oil demand is highly income elastic. If the technical coefficient between crude oil and real GDP is fixed in the short term, then income elasticity could be close to one. Econometric estimates, however, show that short-run income

elasticity ranges between 0.2 and 0.4 (Askari and Krichene, 2008). Thus rigidity of crude supply combing with an expanding world demand for crude oil creates a growing demand–supply imbalances and price hike. Following crude oil, natural gas price was relatively unstable over the time under review in this study. Despite an increase till second quarter of 2008, natural gas price slumps afterwards. The price behavior of natural gas is influenced by a few factors such as the total consumption by the residential, commercial, and electrical power sectors[§§§], which is highly seasonal (Xiaoyi Mu, 2007).

It has been argued that, in addition to fundamental factors influencing commodity price dynamics, the increasing switch of speculators from financial to commodity markets may have played a significant role in contributing to the increase in the level and volatility of some commodity prices in recent years (Alexandra et al, 2011). The motivation for the speculators behind this shifting to commodity markets may be due to the complementary features of financial and commodity markets. Financial markets provide a useful complement to physical commodity markets because they allow consumers and producers to hedge their exposures to movements in commodity prices. These markets exist precisely because prices can be volatile, and allow uncertainty about future price movements to be managed (Alexandra et al, 2011). For instance, a may take a long position in the forward cocoa market well ahead harvesting to ensure the selling prices upon harvesting. Financial investors may provide additional liquidity to these markets, and may improve price innovation.

3.3 Methodology

The study first examines the relation between equity and commodity returns in order to address the main issue of the study. Conventional correlation analysis provides an average correlation over a particular period of time, however, fails to take effects of time changes on correlation into account. The study applies dynamic conditional correlation analysis to overcome this shortcoming. With the DCC model, one can pinpoint precisely the timing and nature of plausible changes in the time series co-movement. For each time point,

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[§§§] Residential consumption includes gas used in private dwellings for space heating, air-conditioning, cooking, water heating, and other household uses. Commercial consumption includes gas used by nonmanufacturing establishments such as hotels, restaurants, wholesale and retail stores, and natural gas vehicles. Industrial consumption includes gas used for heat, power, or chemical feedstock by manufacturing, mining, construction and agriculture industries. Electric power consumption includes gas used as fuel in the electric power sector. For a complete definition of these categories, see www.eia.doe.gov.

the DCC method gives a value that serves as the forecasted correlation between series for the next period. The estimation of DCC is broken into two stages, which simplifies the estimation of a time varying correlation matrix. In the first stage, univariate volatility parameters are estimated using GARCH models for each of the variables. In the second stage, the standardized residuals from the first stage are used as inputs to estimate a time varying correlation matrix. Finally, the study employs Markowitz Portfolio optimization technique in order to find out risk return profiles of optimized portfolios and optimal volume of investment in equities and commodities under review in different episodes. The study constructs four types of portfolios in different market conditions – crisis and non-crisis periods: (a) conventional equities (b) Islamic equities (c) Islamic equities and commodities and (d) Conventional equities and commodities. This portfolio formation further exhibits diversification benefits for the investors from equities and commodities investments. Details of the methodologies are explained in the appendix.

4. Results and empirical analysis

We employ unconditional correlation analysis in order to examine the degree of relationship between equity and commodity returns for the sake of assessing diversification benefits of portfolios combining equities and commodities[****]. Findings of the correlation results show that commodities in general and gold in particular can enhance diversification benefits for investors and portfolio managers both in Islamic and conventional equity markets. Benefits of portfolio diversification can be obtained when the assets in the portfolio are negatively correlated or at least positively correlated with lower degree. Above all, prudent portfolio managers should carefully look at the marginal contribution of any asset before taking into the portfolio, which is again indicated by the correlation coefficient between individual asset's return and the return of the existing portfolio.

4.1 Dynamic Conditional Correlation (DCC) Analysis

Unconditional correlation fails to measure the extent of correlation between assets' returns with the variation in time which can be detected by the dynamic conditional correlations. This test is significant since we would like to investigate diversification

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[****] We do not report the detailed results of the unconditional correlation analysis here but results and analysis are available upon request.

benefits and risk-return profiles of optimal portfolios combining equities (conventional and Islamic) and commodities in six sub-periods. We present the summary of dynamic conditional correlation analysis in the following tables 3 and 4[††††].

Results show that Malaysian conventional and Islamic equity returns are positively correlated with most of the commodity returns during and after the 2008 global financial crisis. Maximum correlation between commodity and conventional and Islamic equity returns are +0.25 and +0.29 respectively. However, it observes that most of the commodity returns except for gold return are inversely correlated with the same equity returns before the global financial crisis. This indicates gradual shifting of investment in commodity markets before starting the crisis particularly when commodity investment offers higher return than the investment in equity market. Eventually, returns from the equities and commodities become positively correlated once a large number of investors and portfolio managers started to invest in commodity markets. As a consequence, possible benefits from diversification in commodity market drops. Surprisingly, correlation results are mostly negative during and after the 1997 Asian financial crisis in Malaysia showing potential portfolio diversification benefits from commodity investments. While 1997 Asian financial crisis severely affected a group of East Asian countries including Malaysia and Japan, other economies under review remain mostly unaffected. Most importantly, the investment portfolios of most of the large U.S. investment banks were hardly affected by this crisis and commodity investment seems to be less popular during 1997 Asian financial crisis. Hence, returns from commodity and equity investment move inversely. Results show almost similar findings for time varying correlations between Japanese conventional and Islamic equities, and commodities. The correlation results between returns on commodities and equities from other developed markets such as U.S.A., U.K., and Canada are not much different. For these markets, both conventional and Islamic equity returns are positively correlated with commodity returns during and after the 2008 global financial crisis, while it observes mostly negative relationship between commodity and equity returns during the 1997 Asian crisis. Alternatively, results show mostly either negative or weakly positive correlations between Turkish equity returns and the commodity returns before, during and after the

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[††††] Dynamic conditional correlation figures are not presented here but available upon request.

2008 global financial crisis indicating possible diversification benefits from portfolios combing Turkish equities and commodities. However, the correlation pattern in the GCC market looks different to some extent. In GCC, while there exists mostly inverse relationship between returns on commodities and conventional equity investments, commodity returns are mostly positively related to Islamic equity returns. This finding is even though unlikely but not surprising because many investors from Islamic equity markets in GCC switched to alternative investments in other markets on account of 2009 Dubai financial crisis. Among the gulf countries, Dubai is the first Arab state permits foreign investors to purchase land other real estate properties. Dubai's real estate industry was severely challenged by the 2008 Global financial crisis. Many foreign investors started to withdraw their investments from Dubai's real estate investment in order to adjust their losses from other investments elsewhere because of global economic downturn in 2008. Noticeable, most of the real estates in Dubai were financed by sukuk which is a major Islamic capital market instrument. Hence, a downward property price in Dubai leads to a collapse in Islamic equity market and panicked investors started to invest in alternative investments like commodities. As a matter of fact, economic activities started to resume extensively from the beginning of 2010 to recover economic losses. This improved growth outlook had a visible impact on financial markets: equity prices rose and credit spreads tightened in major developed economies. Government bond yields also increased significantly, reflecting both higher expected real yields due to anticipated monetary policy tightening and higher expected inflation.[‡‡‡‡]

Overall, these results show the possibility of lower diversification benefits during the post 2008 crisis period. The results also reveal that returns from gold investment are inversely related to the Malaysian, Japanese and the U.S. equity returns in general and during financial crisis period in particular. What would be the implication of these findings? For example, portfolio managers, faced with a continuous downturn in equities, may find safe haven for their investment in commodities, specifically, in gold. Results further establish that other commodities such as cocoa and crude palm oil played a significant role in portfolio diversification mostly before, during and after the 1997 Asian financial crisis.

[‡‡‡‡] Page:1, BIS Quarterly Review, March 2011

Portfolio managers, not only from Asian markets, but also from European and North American markets utilized the benefit of rising prices of these commodities as suggested by the dynamic correlation results. Surprisingly, Islamic equities show no better prospect for the portfolio managers and investors since there is no clear pattern of the correlation dynamics between returns on commodities and Islamic equities. In addition, prices of Islamic equities behave almost like conventional equities and moved with commodity prices. Hence, the correlation between equity (Islamic and conventional) and commodity indices has increased during the financial crises, with the exception of gold. This increased correlation would contribute to declining portfolio diversification benefits of the portfolios of commodities and equities.

4.2 Markowitz Portfolio Optimization

4.2.1 Risk-Return Profile of Optimized Portfolio

We apply the Markowitz Portfolio optimization in order to find out the optimal portfolios and to investigate the risk-return profile of the portfolios under review in different episodes. Harry M. Markowitz (1952; 1959) first developed the modern portfolio theory describing the relationship between expected return and risk of assets. The theory suggests that investors should attempt to maximize the portfolio expected return given the same level of risk or minimize risk of the portfolio given the same level of return. We construct efficient portfolios, which contains only systematic risk and provides the maximum expected return for a given level of risk (volatility) or minimum level of risk for a given level of expected return (Berk & DeMarzo, 2011). Theoretically, the efficient portfolios cannot be diversified further. It is assumed that an investor selects an optimal portfolio from a number of efficient portfolios. We select the portfolio that gives the highest return-to-risk ratio from a set of efficient portfolios combining equities (conventional and Islamic) and commodities across all episodes (sub-periods) considered by the study. Then we find the basic features and performances of those highest return-to-risk efficient portfolios.

The above tables 5(a) – 5(h) present comparative portfolio asset allocation and performances of optimal portfolios combining conventional equities, Islamic equities, conventional equities and commodities, and Islamic equities and commodities respectively across all sub-periods.

4.2.2 Return to risk ratio

We compute return to risk ratio by dividing the annualized return by the annualized risk of the portfolios. If we form portfolios only with conventional equities, we observe from table 5(a) that the highest return-to-risk ratio is 1.25 (15.93%/12.78%) produced by the portfolio in the first sub-period, the time before the 1997 Asian financial crisis. This portfolio is composed of equities from UK (57.26%), Canada (19.32%), Japan (12.72%) and USA (10.71%). This portfolio composition could be influenced by lower return correlation, better performance and relative resiliency of the concerned equity markets, which may encourage the investors and portfolio managers to invest in these equity markets. Conversely, we notice that the lowest return-to-risk ratio is 0.52 (8.18%/15.67%) in the third sub-period, the post 1997 Asian financial crisis period. This portfolio is composed of 54.31% Canadian and 45.69% Malaysian equities, both of which were adversely affected by the financial crises. Malaysian equities were hit by the 1997 financial crisis and Canadian equities by the Internet bubble burst and other crises. These findings suggest that conventional equity portfolios perform relatively better at the outset of 1997 Asian financial crisis.

How is the performance of the Islamic equity portfolios if the investors like to invest in Islamic equities due to religious or other ethical reasons? Now we look at the reward-to-risk ratio of the Islamic equity portfolios during the same tenure in order to investigate the performance of Islamic equity portfolios. The highest return-to-risk ratio of Islamic equity portfolios is 2.54 (22.29%/8.77%) in the first sub-period. Surprisingly, this portfolio is composed of the Islamic equities from the identical markets as those of conventional equity portfolios but with different asset allocation weights. This portfolio consists of the Islamic equities from UK (44.86%), Canada (28.35%), USA (24.13%) and Japan (2.65%). On the other hand, result shows that the lowest return to risk ratio of Islamic portfolios is 0.22

19

(3.56%/16.22%) and this portfolio is composed of Islamic equities from Malaysia (52.55%), Japan (28.00%) and Canada (19.45%) in the third sub-period which is the post 1997 Asian financial crisis period. As a matter of fact, all these markets observe severe downturn in the third sub-period due to financial crises.

Interestingly, the results show that Islamic equity portfolios perform better (2.54 vs. 1.25 in episode 1 and 1.37 vs. 1.15 in episode 2) than their conventional counterpart in terms of return-to risk ratio in the first and second sub-periods. However, conventional equity portfolios perform better (0.52 vs. 0.22) than the Islamic portfolios in the third sub-period. These findings suggest that Islamic equities perform better and thus regarded as safer investments than the conventional equities during the 1997 Asian financial crisis in general. This finding may not be surprising if we look into the causes and effects of the 1997 Asian financial crisis. In brief, currency crisis was the main issue that triggered the intensity of this crisis in the major Asian economies such as Korea, Japan, Hong Kong, Taiwan, Malaysia and Thailand. In other words, overall financial sector output in these economies dropped severely in general and conventional equity markets in particular. In spite of the rapid downfall in conventional equity markets, Islamic equity markets were less affected by this financial crisis due to the exclusion of financial sectors in the Islamic equities during the screening stage to maintain Shariah compliance.

What happens to these Islamic and conventional equity portfolios in episodes 4, 5 and 6 – the time before, during, and after the 2008 Global financial crisis? This crisis was caused by the successive failures of the residential mortgages initiated by the multi-layering process of mortgages of the financial institutions. In other words, the real estate market crash in the U.S. market spilled over to other developed and emerging markets in general. A huge failure in the U.S. residential mortgage market is the fundamental cause of the 2008 global financial crisis. Accordingly, we expect that the Islamic equity markets would be more affected as compared to its conventional counterpart during this crisis period since this crisis was initiated in the U.S. real estate market. What happens in reality? The results at the onset of the 2008 Global crisis show that the risk-to-return ratio is 1.25 (13.49%/10.82%) for the conventional equity portfolio as compared to 1.11(14.48%/13.06%) for the Islamic equity portfolio, i.e. conventional equity portfolio performed better, by 12.61%, than the Islamic

equity portfolio. While a conventional portfolio is composed of equities from GCC (39.87%), Canada (39.07%), Malaysia (14.16%) and Turkey (6.90%), composition of Islamic portfolio is almost identical to the conventional portfolio except for the additional equity from the UK market. However, the proportion of equities are different the Islamic portfolio.

There is hardly any significant improvement in portfolio performance results during the 2008 Global crisis period from the pre-crisis period, rather the performance of the Islamic equity portfolios was about 500% worse than their conventional counterpart. The results show that the return-to-risk ratio of the Islamic equity portfolios was 0.31 (6.14%/19.83%) as opposed to 1.91 (21.97%/11.48%) of the conventional equity portfolios. The results also demonstrate that conventional equity portfolio is composed of equities from GCC (86.73%) and Malaysia (13.27%) while Islamic equity portfolio is composed of equities from Malaysia (76.76%) and Turkey (23.24%). We may notice from the findings that neither conventional nor Islamic portfolios are accounted for equities from either North America or Europe, since markets in both continents were severely plunged by the 2008 Global financial crisis.

Results show that performance of both Islamic and conventional equity portfolios is almost similar during the post 2008 Global financial crisis. During this time conventional equity portfolio comprises of only Malaysian equities with a return-to-risk ratio of 0.82 (12.20%/14.91%) which indicates least vulnerability in Malaysian stock market due to this crisis. Conversely, return-to-risk ratio is 0.83 (10.59%/12.70%) for the Islamic portfolio that is composed of equities from Malaysia (80.82%), Turkey (11.52%), GCC (5.63%) and U.S.A. (2.03%). These findings again highlight the better performance of the Malaysian equity markets than the other markets under review. The contribution of GCC Islamic equities in this portfolio appears to be very small may be due to poor performance of the Islamic equities. This happens because of the 2009 Dubai financial crisis originating from the huge default in sukuk market.

Earlier results show that commodity prices move in inverse direction of equity prices in most of the cases. Consequently, we need to investigate the risk-return behavior of the portfolios combining equities (conventional and Islamic) and different commodities. These portfolios combining equities and commodities are expected to provide diversification

benefits for the losing portfolio managers and investors during the financial crises. For example, Jessica et al (2012), in their paper stated that there is no doubt that investors would like, and are trying, to achieve diversified returns by allocating their capital to non-traditional and non-standard investment instruments.

The results in the first sub-period reveal that the return-to-risk ratio is 1.50 (16.74%/11.15%) for the portfolio combining conventional equity with commodities as compared to 2.70 (21.27%/7.89%) for the portfolio combining Islamic equities with commodities. Therefore, Islamic equity-commodity portfolio performs better by 80% than the conventional equity-commodity portfolio. Investors might be interested in knowing which diversified portfolio performed better? Apparently, in terms of the return-to-risk ratio, Islamic equity-commodity portfolio performed better than the conventional counterpart because of higher return-to-risk ratio (2.70 > 1.50). Meanwhile, in terms of reduction in volatility, conventional equity-commodity portfolio performs better than Islamic equity-commodity portfolio (1.63% > 0.88%). In order to know the causes behind such interesting findings, we better look at the portfolio composition. Asset allocation results demonstrate that the conventional equity-commodity portfolio comprises of four equities from U.K. (39.62%), U.S.A. (12.37%), Japan (8.73%) and Canada (7.89%), and two commodities, cocoa (29.65%) and crude oil (1.65%). Similarly, the Islamic equities-commodities portfolio consists of four Islamic equities from U.K. (38.74%), Canada (23.86%), U.S.A. (18.79%) and Japan (4.01%), and two commodities, cocoa (12.65%) and crude oil (1.95%). Results finally conclude that the highest and the lowest contribution appear from the U.K. equities and crude oil respectively in both portfolios which is consistent with the U.K. equity contribution in both non-diversified portfolios. These findings highlight the superior performance of the U.K. equities, both conventional and Islamic, in episode 1, i.e. before the start of the 1997 Asian financial crisis.

Now we look at the performance of the diversified portfolios in episode 2, during the 1997 financial crisis. Results reveal that the return-to-risk ratio is 1.44 (20.98%/14.53%) for Islamic equities-commodities portfolio, which is higher than the return-to-risk ratio of 1.23 (15.82%/12.81%) of conventional equities-commodities portfolio by 17%. This increment is about 63% (80% - 17%) less than the same sort of performance of Islamic equities-

commodities portfolio in episode 1. The results also report that portfolio volatility has been reduced by 1.84% (14.65% - 12.81%) for the conventional equity-commodity portfolio against the Islamic equity-commodity portfolio, for which volatility has been reduced by 2.02% (16.55% - 14.53%). Therefore, it would not be overwhelming to claim that Islamic equities-commodities portfolio performed better than its conventional counterpart during the 1997 Asian financial crisis period. This finding is interesting but not surprising because of failures in financial sectors does not affect the performance of Islamic equities since financial sectors are excluded from the Islamic equities through the process of Shariah screening. Asset allocation wise, the contribution of the UK equities is still the highest (42.68% for conventional vs. 43.10% for Islamic) in the equity-commodity portfolios in episode 2 when crude palm oil could be regarded as the major commodity to contribute (16.73% for conventional vs. 17.26% for Islamic) in the diversified portfolios. This asset selection depends on the low return correlation and overall performance of the assets.

After the 1997 Asian financial crisis, in episode 3, results report that return-to-risk ratio is 0.75 (9.39%/12.54%) for Islamic equities-commodities portfolio, which is less than the return-to-risk ratio of 0.86 (9.90%/11.48%) of conventional equities-commodities portfolio by 14.67%. Although, the performance of Islamic equity-commodity portfolio declines, it would still be interesting to see the extent of diversification benefits of both portfolios in episode 3. According to the results, portfolio volatility has been reduced by 4.19% (15.67% - 11.48%) for the conventional equity-commodity portfolio compared to the Islamic equity-commodity portfolio, for which volatility has been reduced by 3.68% (16.22% - 12.54%). Therefore, in line with the results, it would be safer to claim that conventional equity-commodity portfolio performs better than the Islamic equity-commodity portfolio after the 1997 Asian financial crisis. Interestingly, gold is now appearing as a major diversifier contributing the highest 36.17% and 47.17% in composition of the conventional equity-commodity and Islamic equity-commodity portfolios respectively. In addition to gold, crude oil, natural gas and cocoa are other commodities that contribute to both conventional and Islamic diversified portfolios. In addition to the commodities, both conventional and Islamic equities of Malaysia contribute to the diversified portfolios.

Now we look at the episodes 4, 5 and 6 when failures in the U.S. real estate mortgage market played the key role in the global economic meltdown which triggered the 2008 financial crisis. Before starting of the 2008 Global financial crisis, in episode 4, return-to-risk ratio is 1.48 (14.74%/9.98%) for conventional equity-commodity portfolio which is higher than the return-to-risk ratio of 1.37 (14.09%/10.30%) of Islamic equity-commodity portfolio by about 8%. In terms of portfolio diversification benefits, the results show that portfolio volatility reduces marginally by 0.84% (10.82% - 9.98%) for the conventional equity-commodity portfolio as compared to the Islamic equity-commodity portfolio, for which volatility decreases by 1.30% (13.06% - 10.03%). Therefore, in spite of higher return-to-risk ratio of the conventional equity-commodity portfolio, Islamic equity-commodity portfolio provides higher diversification benefits as compared to its conventional counterpart by reducing portfolio volatility in episode 4.

Following the results in episode 4, diversified conventional equity-commodity portfolio performs better than the Islamic equity-commodity portfolio with respect to the return-to-risk ratio in episode 5. The results show that return-to-risk ratio is 2.06 (22.12%/10.76%) for conventional equity-commodity portfolio which is higher than the return-to-risk ratio of 0.73 (16.12%/21.96%) for Islamic equity-commodity portfolio by about 182%. The results further explain that portfolio volatility drops marginally by 0.72% (11.48% - 10.76%) for the conventional equity-commodity portfolio as compared to the Islamic equity-commodity portfolio, for which volatility falls by 2.13% (21.96% - 19.83%) after adding commodities into the portfolio. This higher volatility increases return by 10%. This higher return is achieved by the higher contribution of gold (72.90%) in the diversified Islamic equity-commodity portfolio. Gold, as an important diversifier, played second leading role even in the conventional equities-commodities portfolio (14.58%).

In the final episode 6, Islamic equity-commodity portfolios performs marginally better than its conventional counterpart by about 2% attributed to the higher contribution of the Malaysian equities, gold and crude palm oil in both diversified Islamic and conventional portfolios. Furthermore, the results show that portfolio volatility shrinks by 3.49% (14.91% - 11.42%) for the conventional equity-commodity portfolio as opposed to the Islamic equity-commodity portfolio, for which volatility has declined by 2.03% (12.70% - 10.67%) after

adding commodities into the portfolio. Malaysian equities, gold and crude palm oil are playing the significant role in both conventional and Islamic diversified portfolios.

The above results highlight a few major findings. *First*, Islamic equities, on an average, perform better than the conventional equity during 1997 Asian financial crisis. On the contrary, conventional equities perform better than the Islamic equities during the 2008 global financial crisis. *Second*, both conventional and Islamic equities from U.K., U.S.A. and Canada played leading contribution in both diversified and non-diversified portfolios before and during the 1997 Asian financial crisis. *Third*, Asian equities (both Islamic and conventional) such as equities from Malaysia, Japan, GCC and Turkey came to the forefront to contribute to the diversification process in episodes 4, 5 and 6, centering around the 2008 Global financial crisis. *Fourth*, commodities such as cocoa, crude oil and crude palm oil appeared as good diversifier throughout the first, second and third episodes. On the other hand, gold became the major diversifier during the fourth, fifth and the final episodes. In other words, gold played a major role with equities in achieving portfolio diversification benefits. *Fifth*, benefit of portfolio diversification through commodities is not significant. Despite this fact, Islamic equity-commodity portfolio provides relatively higher diversification benefit as compared to the conventional equity-commodity portfolio during the 1997 Asian financial crisis. However, conventional equity-commodity portfolio provides relatively larger benefit as compared to the Islamic equity-commodity portfolio during the 2008 Global financial crisis.

The above major findings suggest the following: (a) Islamic equities are more exposed to a financial crisis caused by the deterioration of the real sector in the economy. Conversely, conventional equities are more exposed to the catastrophe in the financial sector. This happens because of the exclusion of the financial sector in the Islamic equities through Shariah screening criteria, (b) equities from the European and North American markets would be superior investment instrument and thus better portfolio components in terms of higher marginal benefits during the 1997 Asian financial crisis, (c) Asian equities would be superior diversifier in terms of higher marginal benefits during the 2008 global financial crisis, (d) gold would be a major diversifier when all equities in general and Islamic

25

equities in particular experience major downturn and (e) most of the commodities except for gold gradually became less important components for a diversified portfolio.

4.2.3 Sharpe ratio

In addition to return-to-risk ratio, we apply Sharpe ratio to measure the performance of all portfolios combining equities (conventional and Islamic) and commodities across all sub-periods. Results show that Sharpe ratio is 0.04, 0.05 and 0.02 for the conventional equities portfolio in episodes 1, 2 and 3 respectively. We observe that risk-adjusted performance of the portfolio is highest in episode 2, which is contradictory with the return-to-risk ratio results since return-to-risk ratio of the portfolio is the highest in episode 1. This contradictory result attributes to the risk-free rate was higher in episode 1, which makes the Sharpe ratio smaller. Lowest Sharpe ratio in the third episode could be due to the highest volatility of portfolio returns in the same period, although, risk-free rate gradually declines. What happens to the Sharpe ratio if commodities are combined with conventional equities across the same periods? The results show that Sharpe ratios are 0.04, 0.05 and 0.03 for conventional equity-commodity portfolios in the first, second and third episodes. In fact, there seems to be no significant changes in Sharpe ratio except a minor increase in the third episode. The results show that there is a minor improvement in risk adjusted benefits for the investors even after diversification of their portfolios with commodities. Furthermore, it could be argued that even commodities may not serve as a perfect diversifier during crises. Results further report that Islamic equities portfolio provides Sharp ratios of 0.12, 0.07 and 0 in the first, second and third episodes. We observe highest Sharpe ratio in the first episode, which is concomitant with the highest return-to-risk ratio for the same portfolio during the same period. Sharpe ratio is zero for Islamic equity- commodity portfolio in the third episode because return-to-risk ratio for the same portfolio is the lowest in the third episode for the same portfolio. Zero value of Sharpe ratio is not surprising since we adjust risk-free rate with the total rate of return while computing Sharpe ratio. How do the investors react after the diversification of their portfolio with commodities? The results show that Sharpe ratio has improved to 0.01 in the third episode owing to diversification by commodities, where gold played the key role in producing higher return.

26

Results of return-to-risk ratio already suggests that conventional equities performed relatively better than the Islamic equities in the fourth, fifth and sixth episodes centering around the 2008 Global financial crisis. We observe the same value of Sharpe ratios, 0.05 and 0.12, for both non-diversified conventional equities portfolio and diversified conventional equity-commodity portfolios in fourth and fifth episodes respectively. However, Sharp ratio improves marginally by 0.01 from 0.05 to 0.06 due to diversification with commodities. Results suggest that Malaysian equities and gold play a key role in this diversification process. The results also indicate larger improvement in Sharpe ratio of Islamic equities portfolio through diversification with commodities in the fifth and sixth episodes. In contrast, no evidence of improvement in Sharpe ratio is observed in the fourth episode because of diversification. Again gold, cocoa and crude palm oil played key role in this diversification process.

The above results of Sharpe ratio suggest that except for a few cases, commodities in general and gold in particular play a key role in improving risk adjusted return through diversification of equity portfolios. The results show that there is a marginal improvement in risk adjusted return. The results further demonstrate that the risk adjusted return for Islamic equity-commodity portfolio appears to be marginally higher than its conventional counterpart. With respect to the quality of diversifier, commodities such as gold, cocoa and crude palm oil in general and gold in particular, play a key role in diversification.

5. Concluding remarks and policy implications

The main objective of the paper is to investigate the risk-return profiles of optimized portfolios combining (a) conventional equities (b) Islamic equities (c) Islamic equities with commodities and (d) conventional equities with commodities during crises and non-crises periods. We employ unconditional correlation analysis in order to examine the degree of relationship between equity and commodity returns for the sake of assessing diversification benefits of portfolios combining equities and commodities[§§§§]. Findings of the correlation results show that commodities in general and gold in particular can enhance diversification benefits for investors and portfolio managers both in Islamic and conventional equity

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[§§§§] We do not report the detailed results of correlation analysis here due to space constraint. However, results and analysis are available upon request.

markets. Benefits of portfolio diversification can be obtained when the assets in the portfolio are negatively correlated or at least positively correlated with lower degree.

Unconditional correlation fails to measure the extent of correlation between assets' returns with the variation in time which can be detected by the dynamic conditional correlations. This test is significant since we would like to investigate diversification benefits and risk-return profiles of optimal portfolios combining equities (conventional and Islamic) and commodities. Results show that correlation between equity (Islamic and conventional) and commodity indexes has increased during the financial crises, with the exception of gold. This increased correlation would contribute to declining portfolio diversification benefits of the portfolios of commodities and equities. Results further indicate that other commodities such as cocoa and crude palm oil played a significant role in portfolio diversification mostly during 1996 – 2003 episodes, when a rise in these commodity prices was concomitant with downward equity markets mostly in Asia due to 1997 Asian Financial crisis.

We finally employ Markowitz Portfolio Optimization model in order to investigate the risk-return profiles and the extent of diversification benefits of portfolios combining equities (conventional and Islamic) and commodities. A few major findings of optimization results are: *First*, Islamic equities, on an average, perform better than the conventional equity during 1997 Asian financial crisis triggered by the financial sector. On the contrary, conventional equities perform better than the Islamic equities during the 2008 global financial crisis triggered by the real housing sector. *Second*, commodities such as cocoa, crude oil and crude palm oil appear as effective diversifier throughout the first, second and third episodes. On the other hand, gold becomes the major diversifier during the fourth, fifth and the final episodes. In other words, gold plays a major role with equities in achieving portfolio diversification benefits. *Third*, risk adjusted return performance of Islamic equity-commodity portfolios improves marginally compared to their conventional counterparts. And *finally*, except for a few cases, commodities in general and gold in particular play a key role in improving risk adjusted return through diversification of equity portfolios.

These findings have several policy implications. Evidence of theoretical relationship of the equity and commodity indexes (markets) indicates the presence of common factors that may limit the degree of independent variation among the markets. Basically, common factors imply lack of barriers and free capital flows among the markets to ensure that investors can exploit arbitrage opportunities in different markets. Prudent investors and portfolio managers would look into the correlation and volatility of other alternative assets in addition to equities. Empirical findings advocate that price of major commodities such as gold, crude oil, natural gas, cocoa and crude palm oil etc. show either negative or low correlation with both Islamic and conventional equities. Consequently, it would be safer for the investors to include these commodities in general and gold in particular in their portfolios in order to achieve better diversification benefits. However, contribution of crude oil in portfolio diversification would fluctuate more than other commodities since stock price usually move in reverse direction in a crude oil importing economy. Similarly, price and demand of natural gas seem to be highly fluctuating over time due to seasonal factors and therefore, it may play relatively insignificant role in producing diversification benefits. Alternatively, gold would be the safety haven for the portfolio managers and investors to obtain diversification benefits since increasing price of gold seems to be in tandem with decreasing price of equities across time and regions. The relative benefits of investment in commodities may disappear soon due to at least two reasons: (a) in most cases, commodity prices are relatively speculative and unstable. For example, prices of food commodities increased over the last decade due to financialization of commodities and production of biofuels; and (b) high price of commodities may interrupt the liquidity of investments. For example, empirical findings indicate that precious metal, specifically, gold prices sky rocketed over the last decade turning it to a safety haven for the investors. This trend may turn back one stage because it would be difficult to find investors in gold due to excessive high price since production and supply of gold are controlled by a few hands in the global market.

Policy makers may adopt several measures to recover the plummeted equity markets, to stabilize commodity markets and thereby protect the investors. One option would be to limit the financial derivatives in general and specifically, in essential commodity

market and thereby establish a highly regulated and limited financial derivative markets. Moreover, sovereign sukuks (Islamic bonds) and other sovereign debt instruments should be extensively encouraged for the infrastructure development projects across countries. This measure would increase the supply of high grade government securities for the investors in the markets. Issuers should seriously consider gold backing for their investment instruments to create stable and enhance real value of their investments.

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Note: The study reports the most important and critical results only due to page constraint. Supplemental results and tables are available upon request.

Table 1: All episodes (Sub-periods)

Tenure of Financial Crises	Financial Crises	Episodes
January, 1996 – June, 1997	Pre 1997 Asian Financial Crisis	1
July, 1997 – December 1998	Asian Financial Crisis period	2
January 1999 – December, 2003	Post Asian Financial Crisis period	3
January, 2004 – August 2008	Pre 2008 Global Financial Crisis	4
September 2008 – December 2009	2008 Global Financial Crisis	5
January 2010 – June 2012	Post Global Financial Crisis	6

Notes: The above table presents total six episodes (sub-periods) under review in this study

Table 2: Data description

Islamic Stocks	
Variables	**Explanation**
CAIS	Canadian Islamic stock index return
EUIS	European Islamic stock index return
GCIS	GCC Islamic stock index return
JPIS	Japanese Islamic stock index return
MYIS	Malaysian Islamic stock index return
TRIS	Turkey Islamic stock index return
UKIS	United Kingdom Islamic stock index return
USIS	United States Islamic stock index return
Conventional Stocks	
CA	Canadian conventional stock index return
GC	GCC conventional stock index return
MY	Malaysia conventional stock index return
JP	Japanese conventional stock index return
TR	Turkey conventional stock index return
UK	United Kingdom conventional stock index return
US	United States conventional stock index return
Commodities	
COC	Cocoa return
CPO	Crude Palm Oil return
CRO	Crude Oil return
GAS	Natural Gas return
GLD	Gold return

Notes: The above table shows explanation of the Islamic & conventional stock and commodities under review in this study.

(Conventional equities and commodities)

Episodes/ Sub periods	1 (Jan 96 – June 97)	2 (July 97 – Dec 98)	3 (Jan 99 – Dec 03)	4 (Jan 04 – Aug 08)	5 (Sept 08 – Dec 09)	6 (Jan 10 – June 12)
Commodities	Malaysian conventional equity					
COC	- 0.07	- 0.09	- 0.08	- 0.12	+ 0.14	+ 0.20
CPO	- 0.09	- 0.18	- 0.10	- 0.15	+ 0.21	+ 0.02
CRO	+ 0.10	+ 0.08	+ 0.10	- 0.10	+ 0.25	+ 0.21
GAS	+ 0.08	+ 0.10	- 0.10	- 0.12	+ 0.12	+ 0.11
GLD	- 0.04	+ 0.01	- 0.17	+ 0.21	+ 0.03	+ 0.14
	Japanese conventional equity					
COC	+ 0.13	- 0.05	- 0.10	+ 0.20	+ 0.24	+ 0.19
CPO	- 0.05	- 0.09	- 0.07	+ 0.10	+ 0.16	+ 0.15
CRO	+ 0.02	- 0.10	+ 0.15	- 0.20	+ 0.27	+ 0.26
GAS	+ 0.12	- 0.12	- 0.16	- 0.11	- 0.01	- 0.07
GLD	+ 0.10	+ 0.16	- 0.18	+ 0.26	- 0.05	- 0.09
	U.K. conventional equity					
COC	+ 0.12	-0.06	-0.10	+0.17	-0.04	-0.12
CPO	- 0.10	-0.10	-0.12	-0.16	-0.02	+0.10
CRO	- 0.08	-0.11	- 0.15	-0.10	+0.11	+0.15
GAS	+ 0.05	-0.10	-0.15	- 0.05	+0.10	+0.10
GLD	- 0.11	+0.11	-0.16	-0.10	+0.08	-0.10
	U.S.A. conventional equity					
COC	-0.07	-0.06	-0.12	+0.15	+0.30	+0.35
CPO	-0.05	-0.15	-0.11	-0.10	+0.25	+0.30
CRO	+0.05	+0.06	+0.16	- 0.15	+0.44	+0.5
GAS	+0.11	+0.05	-0.12	+0.15	+0.20	+0.20
GLD	- 0.17	-0.25	- 0.35	+0.20	-0.15	-0.10
	Canadian conventional equity					

COC	-0.07	+0.05	-0.15	+0.27	+0.35	+0.37
CPO	-0.08	-0.20	-0.08	+0.16	+0.36	+0.35
CRO	+0.05	+0.06	+0.18	+0.42	+0.57	+0.60
GAS	+0.12	-0.08	+0.20	+0.28	+0.25	+0.24
GLD	-0.18	-0.14	-0.15	+0.55	+0.15	+0.40
	GCC conventional equity					
COC	n.a.	n.a.	n.a.	-0.18	+0.09	-0.12
CPO	n.a.	n.a.	n.a.	-0.08	-0.06	-0.18
CRO	n.a.	n.a.	n.a.	+0.18	-0.08	-0.14
GAS	n.a.	n.a.	n.a.	-0.10	+0.11	+0.14
GLD	n.a.	n.a.	n.a.	+0.20	-0.07	-0.13
	Turkish conventional equity					
COC	n.a.	n.a.	n.a.	-0.10	+0.10	-0.09
CPO	n.a.	n.a.	n.a.	-0.13	+0.10	-0.08
CRO	n.a.	n.a.	n.a.	-0.12	+0.11	+0.10
GAS	n.a.	n.a.	n.a.	-0.10	-0.05	-0.07
GLD	n.a.	n.a.	n.a.	+0.20	+0.15	-0.07

Note: The above table summarizes the conditional correlation results between returns on conventional equities and commodities. Equity return data for GCC and Turkey is not available during the first three sub-periods that is represented by "not accepted (n.a.)

Table 4: Summary of conditional correlation movement

(Islamic equities and commodities)

Episodes/ Sub periods	1 (Jan 96 – June 97)	2 (July 97 – Dec 98)	3 (Jan 99 – Dec 03)	4 (Jan 04 – Aug 08)	5 (Sept 08 – Dec 09)	6 (Jan 10 – June 12)
Commodities	Malaysian Islamic equity					
COC	+ 0.07	+ 0.05	- 0.07	- 0.10	+ 0.20	+ 0.20
CPO	+ 0.07	- 0.08	- 0.15	- 0.15	+ 0.25	+ 0.20
CRO	- 0.08	- 0.03	- 0.07	+ 0.14	+ 0.26	+ 0.29
GAS	- 0.07	- 0.03	+ 0.03	- 0.10	+ 0.05	+ 0.04
GLD	- 0.04	+ 0.07	- 0.07	+ 0.24	+ 0.10	+0.12
	Japanese Islamic equity					
COC	- 0.08	- 0.05	- 0.08	+ 0.20	+ 0.20	+ 0.24
CPO	+ 0.05	- 0.06	- 0.05	+ 0.09	+ 0.15	+ 0.18
CRO	- 0.05	- 0.06	- 0.06	- 0.20	- 0.26	+ 0.30
GAS	+ 0.10	- 0.08	- 0.11	- 0.10	+ 0.12	- 0.05
GLD	- 0.09	- 0.10	- 0.15	- 0.01	- 0.07	- 0.10
	U.K. Islamic equity					
COC	-0.05	-0.06	-0.09	+0.13	+0.10	-0.13
CPO	-0.09	- 0.10	-0.09	- 0.13	-0.04	+0.08
CRO	+0.08	+0.02	+0.08	+0.20	+0.11	+0.15
GAS	+0.14	-0.10	-0.09	+0.15	+0.10	+0.13
GLD	- 0.14	+0.05	-0.10	-0.06	+0.10	-0.09
	U.S.A. Islamic equity					
COC	-0.06	-0.05	-0.05	+0.20	+0.28	+0.35
CPO	+0.05	-0.08	-0.09	-0.10	+0.27	+0.26
CRO	-0.05	+0.04	+0.15	-0.14	+0.45	+0.55
GAS	+0.08	-0.07	-0.08	+0.20	+0.26	+0.05
GLD	-0.20	-0.22	-0.18	+0.22	-0.10	-0.05

	Canadian Islamic equity					
COC	+0.10	+0.10	-0.10	+0.30	+0.40	+0.40
CPO	-0.05	-0.12	-0.09	+0.20	+0.36	+0.37
CRO	-0.05	+0.07	+0.16	+0.50	+0.60	+0.67
GAS	-0.04	+0.03	+0.15	+0.35	+0.33	+0.25
GLD	+0.25	+0.23	+0.30	+0.58	+0.55	+0.50
	GCC Islamic equity					
COC	n.a.	n.a.	n.a.	+0.12	+0.15	+0.15
CPO	n.a.	n.a.	n.a.	-0.09	+0.10	+0.16
CRO	n.a.	n.a.	n.a.	+0.22	+0.20	+0.21
GAS	n.a.	n.a.	n.a.	+0.14	+0.06	-0.08
GLD	n.a.	n.a.	n.a.	+0.14	-0.09	-0.07
	Turkish Islamic equity					
COC	n.a.	n.a.	n.a.	-0.09	+0.15	-0.09
CPO	n.a.	n.a.	n.a.	-0.10	+0.14	+0.15
CRO	n.a.	n.a.	n.a.	-0.12	+0.15	+0.19
GAS	n.a.	n.a.	n.a.	-0.08	-0.04	-0.09
GLD	n.a.	n.a.	n.a.	+0.20	+0.18	-0.05

Note: The above table summarizes the conditional correlation results between returns on Islamic equities and commodities. Equity return data for GCC and Turkey is not available during the first three sub-periods that is represented by "not available (n.a.)

Table 5 (a): Portfolio asset allocation & performance

(Conventional equity: 1996 - 2003)

	1996 - 2003							
	1		**2**		**3**		**Whole**	
Episode	(Jan 1996 – June1997)		(July 1997 – Dec 1998)		(Jan 1999 – Dec 2003)		(Jan 1996 - Dec 2003)	
Type	Assets	Weights	Assets	Weights	Assets	Weights	Assets	Weights
Conventional Equity	UK	57.26%	US	57.45%	CA	54.31%	CA	55.85%
	CA	19.32%	UK	42.55%	MY	45.69%	UK	44.15%
	JP	12.72%						
	US	10.71%						
Annualized Volatility	12.78%		14.65%		15.67%		16.13%	
Annualized Return	15.93%		16.90%		8.18%		6.98%	
Return / Risk	**1.25**		1.15		0.52		0.43	
Sharpe Ratio	0.04		0.05		0.02		0.01	

Note: The above table presents optimal asset allocation, annualized volatility, annualized return, return-risk ratio and Sharpe ratio of optimal portfolios combining conventional equities during 1996 - 2003 (episodes 1, 2, and 3)

Table 5 (b): Portfolio asset allocation & performance

(Conventional equity: 2004 - 2012)

2004 - 2012								
	4		5		6		Whole	
Episode	(Jan 2004 – Aug 2008)		(Sept 2008 – Dec 2009)		(Jan2010 – June 2012)		(Jan 2004 – June 2012)	
Type	Assets	Weights	Assets	Weights	Assets	Weights	Assets	Weights
Conventional Equity	GC	39.87%	GC	86.73%	MY	100.00%	MY	65.66%
	CA	39.07%	MY	13.27%			GC	28.39%
	MY	14.16%					CA	3.66%
	TR	6.90%					TR	2.29%
Annualized Volatility	10.82%		11.48%		14.91%		12.14%	
Annualized Return	13.49%		21.97%		12.20%		8.28%	
Return / Risk	1.25		1.91		0.82		0.68	
Sharpe Ratio	0.05		0.12		0.05		0.02	

Note: The above table presents optimal asset allocation, annualized volatility, annualized return, return-risk ratio and Sharpe ratio of optimal portfolios combining conventional equities during 2004 - 2012 (episodes 4, 5, and 6)

Table 5 (c): Portfolio asset allocation & performance

(Islamic equity: 1996 - 2003)

1996 - 2003								
	1		2		3		Whole	
Episode	(Jan 1996 – June1997)		(July 1997 – Dec 1998)		(Jan 1999 – Dec 2003)		(Jan 1996 - Dec 2003)	
Type	Assets	Weights	Assets	Weights	Assets	Weights	Assets	Weights
Islamic Equity	UKIS	44.86%	UKIS	50.26%	MYIS	52.55%	USIS	57.44%
	CAIS	28.35%	USIS	49.74%	JPIS	28.00%	UKIS	30.73%
	USIS	24.13%			CAIS	19.45%	CAIS	11.20%
	JPIS	2.65%					Others	0.63%
Annualized Volatility	8.77%		16.55%		16.22%		17.66%	
Annualized Return	22.29%		22.60%		3.56%		7.05%	
Return / Risk	**2.54**		1.37		0.22		0.40	
Sharpe Ratio	0.12		0.07		0		0.01	

Note: The above table presents optimal asset allocation, annualized volatility, annualized return, return-risk ratio and Sharpe ratio of optimal portfolios combining Islamic equities during 1996 - 2003 (episodes 1, 2, and 3)

Table 5 (d): Portfolio asset allocation & performance

(Islamic equity: 2004 - 2012)

	2004 - 2012							
	4		**5**		**6**		**Whole**	
Episode	(Jan 2004 – Aug 2008)		(Sept 2008 – Dec 2009)		(Jan2010 – June 2012)		(Jan 2004 – June 2012)	
Type	Assets	Weights	Assets	Weights	Assets	Weights	Assets	Weights
Islamic Equity	CAIS	34.24%	MYIS	76.76%	MYIS	80.82%	MYIS	65.13%
	GCIS	34.24%	TRIS	23.24%	TRIS	11.52%	TRIS	18.82%
	UKIS	14.76%			GCIS	5.63%	GCIS	14.98%
	MYIS	11.80%			USIS	2.03%	CAIS	1.06%
	TRIS	4.96%						
Annualized Volatility	13.06%		19.83%		12.70%		14.14%	
Annualized Return	14.48%		6.14%		10.59%		8.39%	
Return / Risk	1.11		0.31		0.83		0.59	
Sharpe Ratio	0.05		0.02		0.05		0.03	

Note: The above table presents optimal asset allocation, annualized volatility, annualized return, return-risk ratio and Sharpe ratio of optimal portfolios combining Islamic equities during 2004 - 2012 (episodes 4, 5, and 6)

Table 5 (e): Portfolio asset allocation & performance

(Conventional equities and commodities: 1996 - 2003)

	1996 - 2003							
	1		**2**		**3**		**Whole**	
Episodes	(Jan 1996 – June1997)		(July1 997 – Dec 1998)		(Jan 1999 – Dec 2003)		(Jan 1996 - Dec 2003)	
Type	Assets	Weights	Assets	Weights	Assets	Weights	Assets	Weights
Conventional Equity plus Commodity	UK	39.62%	UK	42.68%	GLD	36.17%	CA	41.88%
	COC	29.65%	US	39.56%	CA	22.07%	UK	32.15%
	US	12.37%	CPO	16.73%	MY	21.53%	CRO	9.58%
	JP	8.73%	GAS	1.03%	CRO	13.62%	GAS	7.52%
	CA	7.98%			GAS	5.29%	COC	5.80%
	CRO	1.65%			COC	1.32%	GLD	3.07%
Annualized Volatility	11.15%		12.81%		11.48%		13.77%	
Annualized Return	16.74%		15.82%		9.90%		6.72%	
Return / Risk	1.50		1.23		0.86		0.49	
Sharpe Ratio	0.04		0.05		0.03		0.01	

Note: The above table presents optimal asset allocation, annualized volatility, annualized return, return-risk ratio and Sharpe ratio of optimal portfolios combining conventional equities and commodities during 1996 – 2003 (episodes 1, 2, and 3)

Table 5 (f): Portfolio asset allocation & performance

(Conventional equities and commodities: 2004 - 2012)

2004 - 2012								
	4		5		6		Whole	
Episodes	(Jan 2004 – Aug 2008)		(Sept 2008 – Dec 2009)		(Jan2010 – June 2012)		(Jan 2004 – June 2012)	
Type	Assets	Weights	Assets	Weights	Assets	Weights	Assets	Weights
Conventional Equity plus Commodity	GC	30.23%	GC	77.53%	MY	48.78%	GLD	38.34%
	CA	13.66%	GLD	14.58%	GLD	31.63%	MY	35.86%
	MY	13.52%	MY	7.89%	CPO	19.09%	GC	18.88%
	CRO	12.84%			Others	0.50%	CPO	5.30%
	GLD	10.58%					TR	1.63%
	TR	6.59%						
	CPO	6.46%						
	COC	5.75%						
	Others	0.38%						
Annualized Volatility	9.98%		10.76%		11.42%		11.25%	
Annualized Return	14.74%		22.12%		12.38%		10.89%	
Return / Risk	1.48		2.06		1.08		0.97	
Sharpe Ratio	0.05		0.12		0.06		0.04	

Note: The above table presents optimal asset allocation, annualized volatility, annualized return, return-risk ratio and Sharpe ratio of optimal portfolios combining conventional equities and commodities during 2004 – 2012 (episodes 4, 5, and 6)

Table 5 (g): Portfolio asset allocation & performance

(Islamic equities and commodities: 1996 - 2003)

	1996 - 2003							
	1		**2**		**3**		**Whole**	
Episodes	(Jan 1996 – June1997)		(July 1997 – Dec 1998)		(Jan 1999 – Dec 2003)		(Jan 1996 - Dec 2003)	
Type	Assets	Weights	Assets	Weights	Assets	Weights	Assets	Weights
Islamic Equity plus Commodity	UKIS	38.74%	UKIS	43.10%	GLD	47.15%	USIS	41.74%
	CAIS	23.86%	USIS	39.48%	CRO	17.89%	UKIS	17.26%
	USIS	18.79%	CPO	17.26%	MYIS	15.50%	GLD	13.20%
	COC	12.65%	Others	0.16%	JPIS	11.23%	CRO	9.13%
	JPIS	4.01%			GAS	7.61%	GAS	8.02%
	CRO	1.95%			Others	0.62%	COC	6.85%
							CAIS	2.13%
							JPIS	1.66%
Annualized Volatility	7.89%		14.53%		12.54%		13.13%	
Annualized Return	21.27%		20.98%		9.39%		6.14%	
Return / Risk	2.70		1.44		0.75		0.47	
Sharpe Ratio	0.12		0.07		0.01		0.01	

Note. The above table presents optimal asset allocation, annualized volatility, annualized return, return-risk ratio and Sharpe ratio of optimal portfolios combining Islamic equities and commodities during 1996 – 2003 (episodes 1, 2, and 3)

2004 - 2012								
	4		5		6		Whole	
Episodes	(Jan 2004 – Aug 2008)		(Sept 2008 – Dec 2009)		(Jan2010 – June 2012)		(Jan 2004 – June 2012)	
Type	Assets	Weights	Assets	Weights	Assets	Weights	Assets	Weights
Islamic Equity plus Commodity	GCIS	21.25%	GLD	72.90%	MYIS	42.75%	GLD	48.76%
	GLD	18.24%	MYIS	21.98%	GLD	33.53%	MYIS	27.24%
	CRO	15.10%	COC	3.57%	CPO	12.57%	GCIS	9.60%
	USIS	11.91%	TRIS	1.55%	TRIS	8.14%	TRIS	9.28%
	UKIS	8.98%			GCIS	3.01%	CPO	5.12%
	CPO	7.14%						
	COC	6.25%						
	MYIS	5.97%						
	TRIS	5.15%						
Annualized Volatility	10.30%		21.96%		10.67%		12.78%	
Annualized Return	14.09%		16.12%		11.75%		11.69%	
Return / Risk	1.37		0.73		1.10		0.91	
Sharpe Ratio	0.05		0.04		0.06		0.04	

Note: The above table presents optimal asset allocation, annualized volatility, annualized return, return-risk ratio and Sharpe ratio of optimal portfolios combining Islamic equities and commodities during 2004 – 2012 (episodes 4, 5, and 6)