STOCK AND COMMODITY MARKET LINKAGES: AN ARDL APPROACH

Asim Rafiq, Assistant Professor, Hamdard Institute of Management Sciences.
Syed Shabib-ul-Hassan, Vice Chancellor, Hamdard University.
Kiran Jameel Assistant Professor, Hamdard Institute of Management Sciences.

ABSTRACT: *The objective of this research is to investigate the linkages between the Islamic emerging markets & the International commodity markets with the US stock market. Data based on monthly stock prices of Islamic emerging stock markets, USA & international commodity market prices 1995 to 2019. Auto regressive Distributed lag model used to investigate the linkages between these markets. The results revealed that the Islamic Emerging stock markets are not long run linked with USA stock market and there is also no long run relationship between USA and international commodity market. So it is concluded that it will be a beneficial for the both investors in Islamic emerging stock market and in United States for the perspective of the risk management to invest alternatively in these markets if one is not providing the good returns as well in the international commodity market as an alternative investment.*

KEYWORDS: *Islamic Emerging markets, Commodity markets, ARDL, Risk management, Diversification.*

1. Introduction

Analysis of Financial markets integration is the dominant behavior in the field of finance. Investors can be better off if there is a weak integration in the international financial markets by diversifying their portfolios internationally. According to Harry Markowitz internationally diversified portfolios exhibit less risk & higher returns than domestic diversified portfolios. Market risk also known as systematic or Un-diversifiable risk is the risk related to entire market.

Modern Portfolio Theory attributes the globalization of financial markets to reduce the portfolio risk related to a domestic level market risk (Markowitz, 1995). Linkages or the interdependence among the stock markets is crucial issue for the portfolio management, investors would only benefit by diversifying internationally if there is low linkage or interdependence among the markets or segments for the asset allocation decision (Melvin and Norrbin, 2013). USA financial markets are considered to be benchmark market for rest of markets (Cheung and Mak, 1992).

However, as financial crises offended stock markets worldwide investors & traders moved their investment to the commodity market as an alternative class especially in Gold as a safe heaven. International diversification not only reduces the risk of economic instability but also provides growth opportunity in foreign financial markets and down with distinct political & economic structure also these markets are more mature, innovative and regulated than the other less developed markets. There are some studies carried out in emerging and frontier financial markets too but still there is room to do more especially last decades revels that emerging financial markets are the most desirable avenue for the investors & also researchers are interested in these market because they have tendency to become a developed financial markets or they

were in the past, they have characteristics of developed market to the some extent but still yet to have meet the standard of the developed financial markets.

Another crucial issue at macro level is volatility in commodity prices in international markets which fuels inflation. Analysis of linkage between stock and commodity prices are area of interest of the researchers, analyst & investors, as commodities as an alternative investment for most of the portfolio. Firm's uses commodities as a raw material as well and as the demand of their product increases companies buy more raw material which ultimately increases the prices of the commodities. Investors and traders try to identify the trend in one market by simultaneously looking at the other one. Commodities bases economies, industries and firms also hedge by selecting an alternative investment strategy among the asset classes by comparing risk and return.

The core objective of this paper is to investigate the linkage between the USA and the Islamic emerging economies including Iran, Qatar, Pakistan, Indonesia, Malaysia & Bahrain. The rationale behind investigating the linkage with USA is twofold (1) USA financial markets are the benchmark for international markets. (2) International diversification involves currency risk and most of the trade in the world especially in Islamic Countries in US dollars. Islamic emerging financial markets are included with view of that they shared some common social, political, economic & cultural characteristics which have significant impact on the investor & marker behavior.
This study is limited to the Islamic emerging economies including Iran, Qatar, Pakistan, Indonesia, Malaysia & Bahrain & international commodity market prices including commodity prices of Gold and Crude Oil with USA stock market as the benchmark market. Data will consist of monthly stock prices & of commodity prices from 1995-2019.

2. Literature Review

Current research in international stock prices behavior can be categorized into four areas. First French and Poterba (1991) examine that under the framework of mean variance analysis, implies international diversification benefit and correlation among the national equity markets. Second area focus on asset pricing and equity returns are explained by this model (Harvey, 1991; Engel, 1994). Third, King and Wadhwani (1990) investigate shocks among financial markets and transmission of information between national equity markets. Fourth area Cutler, Poterba and Summers (1991) examined that return are as predictable as in the USA stock market.
Grubel (1968) explain his two countries asset classical model that the international diversification benefit only can be enjoy if there is less than one correlation among the markets. Jeon and Chiang (1991) investigate market liberalization, computerized trading systems, deregulation, rapid developments in communication technology and mounting activities by multinational firms as contributing factors to market integration common trading blocks formation and the development also promote the interdependence or linkage among the NAFTA, ASEAN and Eastern Union. Cheung and Mak, (1992) investigate the relationship between the Islamic emerging and

developed financial market and result suggest that USA market is proved to be a "global factor" which plays a vital role in the movement in the Islamic emerging financial markets. Cheung (1993) investigate intertemporal patterns of the coefficient of correlation between Islamic emerging markets and the developed markets and found that there is instability in the coefficient of correlation over the time but confirms the diversification benefits of investment in this particular region. Karolyi & Stulz (1996) examined the co-movement between USA and Japan stock market using daily returns from 1988 to 1992. Result revealed that there is high co-variance and correlation when there is an intense market movement occurred. This suggest that there is no benefit of diversified globally when large shocks in national equity markets. Christofi & Pericli (1999) examine the interdependence among the stock markets of Mexico, Columbia, Argentina, Chile and Argentina during 1992 to 1997. Results suggest that there is high level of interdependence among these markets. Likewise, Choudhry (1997) observed the interdependence among the Brazil, Mexico, Argentina, Chile, Venezuela and the Colombia result are in accordance with the result of Islamic emerging economies, the Latin emerging America showed interdependency.

Contrary to above literature in support of empirical finding for the linkages among the stock markets, Jarrett & Sun (2012) examined the New York & Shanghai stock indices using time series serial correlation for the period of 1991 to 2009. To investigate the co-movement between Shanghai and New York stock market they used the serial correlation and rate of return and volatility of the returns between these two markets and found the positive serial correlation between Shanghai stock prices and the New York stock prices. Using multivariate regression analysis, they found that either of the markets have very low causal effect. They conclude the no integration between the New York and Shanghai stock market. Ranta (2013) applied wavelet analysis to find the co-movement between USA, Japan, UK, Germany and find that unified time-frequency by country and at low frequency are strong. Liu, Pan, & Shieh (1998) investigate how consistent relationship among the developed Islamic markets and the emerging markets. Islamic markets include (Hong Kong, Singapore, Thailand, Japan and Taiwan) and the USA. Data is divided into two subsamples of 2 January 1985 to 16 October 1987, and 19 October 1987 to 31 December 1990. Results suggest that there is an increase in the general equity market and increase in the Islamic Pacific region as well after the 1987 crisis. Ghosh, Saidi & Johnson (1999) examine the long-term relationship between Indian, Japan and US markets in the period of financial crisis of 1997 and find the co-integrated relationship between Indian & the USA stock market but no co-integrated relationship between Japan and Indian stock markets. Cha & Oh (2000) investigate the interdependence among the stock market of Islamic emerging markets including Singapore, Hong Kong, Taiwan & Korea) with Japan & USA. Study concluded that there is increase in co-movement between Islamic emerging markets with USA & Japan after the stock market crash of

1987. Narayan, Smyth, & Nandha (2004) examined the four south Islamic stock markets including Karachi stock exchange (KSE 100) for Pakistan, All share for Bangladesh, Colombo SE All shares for Srilanka & Bombay SE National 200 for India. In addition to descriptive statistics, Granger causality & variance decomposition is used. Result suggests that India, Bangladesh & Sri Lanka have causality on Pakistan. Daly, 2003 examined the ASEAN stock market integration during post crisis interval using daily closing indices from 1990 to 2003 and concluded that there is significant market integration among the ASEAN stock markets. Ibrahim (2005) studied the ASEAN stock market integration from the point of view the Indonesian stock market by applying co-integration and vector auto regressive model during 1988 to 2003. Result suggests that there is co-integration relationship among the ASEAN stock markets. Rua & Nunes (2009) examine the co-movement among developed financial markets and find that co-movement differs from country to country but contingent on the frequency level, at low frequency level there is high co-movement and higher the benefits of global diversification. The result also supports the distinction between long- and short-term investors Candelon, Piplack, & Straetmans (2008). Graham, Kiviaho, & Nikkinen (2012) examined the interdependence of USA stock market with 22 emerging stock markets and find there is higher interdependence but relatively less frequent between individual emerging stock markets and USA stock markets. Result suggests that there is higher interdependence between Korea, Brazil and Mexico and USA stock market.

Arshanapalli & Doukas (1993) investigate the developed Japan and USA with the developing markets post crisis of 1987. Sample used from 1986 to 1992 which is split between pre crisis from January 1986 to September 1987 and the post crisis from November 1987 to December 1992. Results suggest that there is no co-integration between developed and the developing markets pre- crisis, but post crisis period showed increase co-integrated relationship. Ratanapakorn & Sharma (2002) examined long and short-term interdependence between the Latin America, Europe, Eastern Europe, and Asia & USA for the financial crisis pre & post analysis. Pre-Islamic crisis does not support any long-term relationship but one significant relationship during the crisis was observed. Hee Ng (2002) investigate the linkages among south-east Islamic stock markets during 1988-1997 through the use of co-integration and correlation analysis, covered interest rate parity and a time varying parameter model. Result reveals that there is no co-integrated relationship among ASEAN equity markets, but correlation is found among the markets. Dunis & Shannon (2005) examined the south-east Asia emerging stock markets including Philippines, Indonesia and Malaysia in connection with central Islamic markets including China, Korea, India and Taiwan with three world developed markets including Japan, USA and UK in the meanwhile of post 1997 Islamic financial crisis. Conclusion is that around all the emerging markets are closely connected with Japan stock market. Although there is a steady or declining rate of integration with USA and the UK markets. Rafiq, A., & Hassan, S. (2019) investigate the interdependence of the stocks markets in emerging

economies and found markets are interdependent over the time.

Sadorsky (1999) investigate the relationship between stock prices in USA and the oil prices and observed that positive change in oil prices have significant impact rather than negative change on stock prices. Kilian & Park (2009) investigate the relationship between USA stock and oil prices and observed that 1% variation in real stock returns in USA is due to oil prices shocks in short term. However, 22% of variation is observed in long term. Lin, Fang, & Cheng (2010) investigate the relationship between stock price of oil and gas companies in Poland, Czech Republic, Hungary, Slovenia and Romania. Result suggests that there no relationship between oil prices and the stock prices. Zhang & Wei (2010) applied co-integration & error correction model using daily data from 2000 to 2008, spot oil Brent prices in US dollars and Gold prices & they found that high positive view of correlation between gold and the spot crude oil prices and change in the gold prices caused by change in the crude oil prices. Investigate the impact of gold prices on stock and bonds markets; data is collected from 1970 to 1988. Result suggests that stock and bond markets have negatively correlated with Gold prices.

Sharma, G.D. & Mahendru, M. (2010) also examined the impact of macro-economic variables including Gold prices, inflation, foreign exchange rates using data 2008 to 2009 of Indian economy and result suggest that stock prices have an impact of foreign exchange and gold prices. Moore (1990) Investigate the impact of gold prices on stock and bonds markets; data is collected from 1970 to 1988. Result suggests that stock and bond markets have negatively correlated with Gold prices. Wang and Haung (2010) exchange rates, Oil prices and gold prices of dollars in contrast with stock market of USA, Japan, Germany, Taiwan and China result suggest that there is long term relationship among variables except in USA. Based on the above discussion we can concluded that market interdependence is not a consistent phenomenon it is time varying among the same markets and there is a change in the categories of the countries among developed, developing, emerging economies, advance emerging economies and Frontier markets.

There is also a gap which is that most of the past studies only emphasized on the stock markets only and commodity market has been ignored for a long time, so we also emphasize the commodity market as well as stock market interdependence in Islamic emerging economies' stock markets.

3. Methodology

The sample data is related to stock prices of USA(S&P Shariah Indices Dow Jones Islamic Market Indices), Iran, Qatar, Pakistan, Indonesia, Malaysia & Bahrain & international commodity market prices including commodity prices of Gold and Crude Oil from 1995 to 2019. Statistical data is collected from the Yahoo Finance, International monetary fund & international financial statistics web sites. Closing values of all indices & Gold and the crude oil will be employed for data analysis. Auto Regressive Distributed lag model will be used for the analysis of the linkages

between the Islamic emerging stock market and the international commodity market with USA (S&P Shariah Indices Dow Jones Islamic Market Indices) stock market.

4. Data Analysis.

4.1 Stationary Test

We employed Augmented Dickey Fuller & Phillip Perron tests result suggest that all the variables are stationary at first difference in both type of test except turkey stock market represent by XU100 which is stationary at level in Phillip Perron test of stationary.

4.2 Auto Regressive Distributed Model

There are several econometric techniques in available to test co-integration among the time series data. To test uni-variate time co-integration examples of FMOLS procedures of Phillips and Hansen (1990) & Engle-Granger (1987) are there, for multivariate Johansen Juselius (1990) used. But the multivariate co-integration is only can be used when all the variables are stationary at first difference. To address this issue the proposed technique is Auto regressive distributed lag model (Pesaran and Shin, 1995, 1998; Pesaran et al., 1996; Pesaran et al., 2001).

$\mathbf{Y_t}$ is an explanatory variable, is the constant term, **L** is the lag operator such that $\mathbf{L_{yt} = y_{t-1}}$, w_t is s multiply **1** vector of deterministic variables such as intercept term, time trends, or exogenous variables with fixed lags. The ARDL technique includes two stages for evaluating long run relationship (Pesaran et al., 2001). The initial step is to explore the presence of long run relationship among all factors in the Equation under estimation. The ARDL technique gauges (p + 1) k number of relapses to get ideal slack length for every variable, where p is the greatest number of slacks to be utilized and k is the quantity of factors in the condition. Second phase is to measure the long-run association and short-run bi-directional causality between running actors. We execute second step only, if we catch a long run association in the initial step (Narayan et al., 2005) with unrestricted intercept and unrestricted trends (Pesaran et al., 2001).

4.3. Analysis of Model Selection

Table. 1

Model	**Lag(7)**		**Lag(6)**		**Lag(5)**		**Lag(4)**		**Lag(3)**		**Lag(2)**	
Criteria	**AIC**	**SIC**	**AIC**	**SIC**	**AIC**	**SIC**	**AIC**	**SIC**	**AIC**	**SIC**	**AIC**	**SIC**
	-4.974	-3.559	-4.958	-3.739	-4.9906	-3.9327	-5.028	-4.1268	-5.077	-4.371	-5.090	-4.558

Model selection criteria are AIC & SIC, results suggest that the best possible model is with lag (2).

4.4. Serial Correlation Test of Selected Model

Table. 2

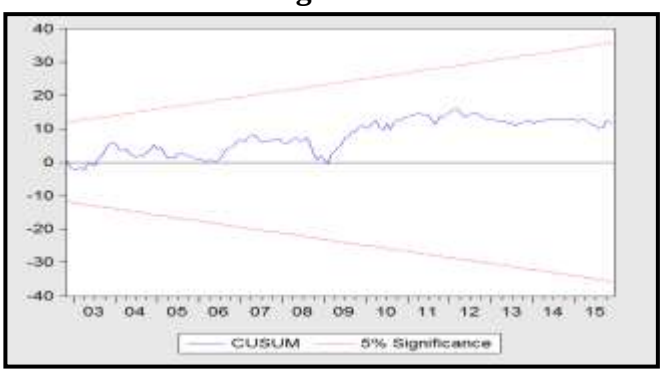
Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.4449	**Prob. F(2,156)**	0.2389
Obs*R-squared	3.4374	**Prob. Chi-Square(2)**	0.1792

After the model selection next step is to test the serial correlation testing and the result shows that there is no serial correlation in the model. Next step is check for the model stability.

4.5. Model Stability

If the blue line under the both two red lines we can consider this model as stable. Result shows that model is stable and we use this model for the examination of the long term relationship between the variables.

Figure. 1



4.6. Test of Co-integration

The asymptotic distributions of F-statistics are non-standard under the null hypothesis irrespective of whether the variables are purely I(0) or I(1), or mutually co-integrated.

Null hypothesis of the co-integration is stated below

H_{o1}: There is no linkage between stock markets of the USA and the Islamic emerging economies.

H_{o2}: There is no linkage between the USA and the International Commodity market.

The data will be analyzed using the criteria of F-values and the upper and the lower

bound value provided by Pesaran and Pesaran (1997). If the F-statics value is greater than the upper bound value, we can reject the null hypothesis of no co-integration. If the values lie between the upper and the lower bound the test will be inconclusive.

Table. 3

Wald Test:			
Test Statistic	**Value**	**df**	**Probability**
F-statistic	2.0588	(10, 158)	0.0308
Chi-square	20.588	10	0.0242
Null Hypothesis Summary:			
Normalized Restriction (= 0)	**Value**	**Std.Err.**	
C(22)	-0.141013	0.062905	
C(23)	0.007037	0.014157	
C(24)	0.010883	0.047064	
C(25)	-0.01712	0.012417	
C(26)	0.094177	0.059056	
C(27	0.019224	0.013892	
C(28)	0.062024	0.07444	
C(29)	-0.072072	0.05342	
C(30)	0.000689	0.038656	
C(31)	-0.014048	0.017934	

4.7. Analysis of the co-integration Test of ARDL

Dependent Variable			**Wald Test**	
S&P 500			**F-Statistics**	**Lag Length**
			2.058881	(2)
Critical Values	**Pesaran et al(2001)**		**Narayan P(2005)**	
	Lower Bound Value	**Upper Bound Value**	**Lower Bound Value**	**Upper Bound Value**
1%	8.74	9.63	10.150	11.230
5%	6.56	7.30	7.080	7.910
10%	5.59	6.26	5.915	6.630

To test for the long term relationship among the variables we run the wald test to check are these variables(Islamic emerging stock market, commodity market & USA stock market) long run integrated or not. Result shows that these variables are not long run co-integrated as the value of F statistics is less than Pesaran & Narayan P lower bound values at 5% level of significance. Finally we conclude that the Islamic Emerging stock markets are not long run linked with USA stock market and there is also no long run relationship between USA and international commodity market. According to research findings it will be a beneficial for the both investors in Islamic emerging stock market and in United States for the perspective of the risk management to invest alternatively in these markets if one is not providing the good returns as well in the international commodity market as an alternative investment.

5. Conclusion

Researcher has endeavored best to ascertain whether is there any link between USA and Islamic Emerging stock markets and International commodity markets. Monthly data is cognate to stock prices of Islamic emerging stock markets including USA, Iran, Qatar, Pakistan, Indonesia, Malaysia & Bahrain & international commodity market prices including commodity prices of Gold and Crude Oil from 1995 to 2019. Auto regressive Distributed lag model put into the operation to investigate the linkages between USA and the Islamic emerging stock markets and the international commodity market.

First, the researchers, employed Augmented Dickey Fuller & Phillip Perron tests result suggest that all the variables are stationary at first difference in both type of test except turkey stock market represent by XU100 which is stationary at level in Phillip Perron test of stationary. Secondly, to examine the long run linkages Auto Regressive Distributed Model used among the available co-integration technique due to its advantage of different level of stationary. Before run the ARDL regression model first we need to select the best model on the basis of AIC and SIC values, so the suggested model is ARDL lag (2) model then next we check the model stability and find the ARDL lag (2) model is stable for testing long run linkages. The result of ARDL on the basis of criteria of F-values and the upper and the lower bound value provided by Pesaran and Pesaran (1997). If the F-statics value is greater than the upper bound value we can reject the null hypothesis of no co-integration. If the values lie between the upper and the lower bound the test will be inconclusive. Result shows that these variables are not long run co-integrated as the value of F statistics is less than Pesaran & Narayan P lower bound values at 5% level of significance.

Finally, we conclude that the Islamic Emerging stock markets are not long run linked with USA stock market and there is also no long run relationship between USA and international commodity market.

According to research findings it will be a beneficial for the both investors in Islamic

emerging stock market and in United States for the perspective of the risk management to invest alternatively in these markets if one is not providing the good returns as well in the international commodity market as an alternative investment.

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