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PRIMARY RESEARCH

Causality among Stock Market and Macroeconomic Factors: A Comparison of Conventional and Islamic Stocks

Muhammad Hanif [1]*, Arshad Ali Bhatti [2]
[1] Assistant Professor, College of Business Administration, Ajman University, UAE
[2] Assistant Professor, School of Economics, IIIE, International Islamic University, Islamabad, Pakistan

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Abstract. A recent development in financial markets is the creation of Sharī'ah compliant stock universes. Sharī'ah compliant stock universe is featured as socially responsible investments, less levered, and more reflective of the real sector. This study is conducted to understand and document the short-run equilibrium among important macroeconomic indicators and Equity indexesIslamic and conventionalin the post-Sharī'ah-screening era in Pakistan. Comparative study of linkages among stock indexes and macroeconomic variables is of great interest to i) identify the important macroeconomic factors; and ii) document whether Sharī'ah screening of stocks has created any difference (in macro risk factors). We have included eight macroeconomic variables to study integration with stocks for 64 Months' period (07/2011-10/2016). Evidence has been obtained by application of correlation, unit root, OLS-regression and Granger causality tests. Findings suggest that both markets Islamic & conventional are integrated with selected macroeconomic indicators. However, evidence lacks the integration of markets themselves. We identify a set of two variables from real economy exports and workers' remittances-linked with both markets, while the third variable is different for Islamic (industrial production) and conventional (Money Supply (MS)) markets. Important monetary variables interest rate and inflation have shown an insignificant association. Movements of Islamic index are in-line with the theory i.e., disassociation from interest and reflection of the real economy. Movements of conventional index cover both real and monetary sectors.

KAUJIE Classification: L4
JEL Classification: G11, G12

INTRODUCTION

Modern Islamic financial system was envisioned primarily for religious reasons., However, it has also attracted markets beyond religious-following, on account of strengthsincluding

*Corresponding author: Muhammad Hanif
†Email: hanifacma@gmail.com

asset-based financing and socially responsible investingin the post-financial crisis era (2007-08). According to an estimate, Sharī'ah-compliant assets have grown at about 16% per annum from 2007-onward and are expected to cross the figure of US$5 trillion by 2020 (GIFR, 2015). Islamic banking and finance industry has been expanding worldwide with a promising future, given the customer base in billions with increasing incomes (Pew Research Center, 2011). Geographically, Islamic financial system has been developing and expanding in Muslim-majority countries from the Far-East to the North-West Africa. However, the Middle Eastern region is the centre-stage of modern Islamic financial landscape (GIFR, 2015).

The Islamic finance industry has succeeded, to an extent, in developing deposits and investments' management mechanism under Profit and Loss Sharing (PLS). However; avenues for financing and investments for liquidity management are restricted and limited in comparison with the conventional finance industry. Interest-based investment avenues are out of Sharī'ah-based investment universe, and even PLS-based investments are allowed with certain Sharī'ah restrictions (AAOIFI, 2010). A well-defined and established principle of Islamic financing is "*al-kharāj bi-ḍamān*" (linkage of profit/gain with risk/responsibility). In other words, profit on capital is linked with bearing the risk of loss in business; otherwise, it is *ribā* (interest & usury), forbidden by Sharī'ah. Perpetual and redeemable equities including stocks and *ṣukūk*/certificates/funds fulfil the requirements of risk and return sharing principles of Islamic finance, with certain restrictions. There exist dozens of Islamic indices (e.g., Dow Jones Islamic Market Index (DJIM), Financial Times Stock Exchange (FTSE), Standard & Poor's (S&P), KSE-Meezan Index (KMI), etc.) engaged in Sharī'ah-screening of the investment universes, based on predefined Sharī'ah-compliance filters and AAOIFI guidelines.

How to value Islamic securities is an interesting question for Islamic investors, especially the identification of underlying factorscontributing to the risk of Sharī'ah-compliant stock returns. Under the conventional financial system, much work has been done in the area of asset pricing [e.g., Capital Asset Pricing Model (CAPM) and APT/Multifactor models]. In case of Islamic finance, individual efforts to propose an asset pricing model for valuation of Islamic securities have been done, primarily focusing on CAPM (e.g., El-Ashkar, 1995; Hakim, Hamid, Meera, & Kameel, 2016; Hanif, 2011; Hanif, Iqbal, & Shah, 2016; Shaikh, 2010; Tomkins & Karim, 1987). Few studies have covered selected Islamic capital markets through the application of conventional models (e.g., Hakim & Rashidian, 2004; Hassan & Girard, 2010; Hassan, Khan, & Ngow, 2010; Hussin, Muhammad, Abu, & Awang, 2012; Majid & Yusof, 2009; Rana & Akhter, 2015; Yusof, Majid, & Shabri, 2007). However, still concrete evidence lacks for risk factors of various Islamic capital markets, and this study is an effort to fill this gap in the literature.

The purpose of this study is to search for important macroeconomic variables associated with the cross-section of stock returns, in the domestic market. It is to document the risk factors (macroeconomic variables), comparatively, for Sharī'ah-compliant as well as conventional securities to understand similarities and differences in the Pakistani market. in the Sharī'ah-screening perspective. Identification of macroeconomic variables integrated with

stock returns is an important research area in the literature of financial markets. An interesting finding of the study would be whether Sharī'ah-screening has changed the risk factors of stocks' returns in the domestic market. Chen, Roll, and Ross (1986) postulate that general economic state variables are expected to influence the prices of stock aggregates. We intend to search for those macroeconomic variables, which contribute to variations of stock returns in the domestic markets conventional and Islamic. Our study is timely, as Sharī'ah screening process has completed eight years in June 2016 and numerous Islamic equity mutual funds have been established in Pakistan and elsewhere, in addition to other developments in the region. Furthermore, Pakistan Stock Exchange (PSX) has shown healthy performance in recent years, and its co-integration is very low with developed markets (Hasan, Saleem, & Abdullah, 2008) offering an opportunity for portfolio diversification by the global investors. We selected the Pakistani market on account of its strategic location in South Asia a fast-growing region in the first decade of the 21st century. Moreover, PSX[1] has shown a consistent performance, over the years as a result, it was included in top performing markets in 1991, 2002 & 2016. Besides, Pakistan has negotiated the China-Pakistan Economic Corridor (CPEC), which is being well appreciated as a game changer in the region (H-Times, 2016).

Our study documents interaction among stock indexes and selected macroeconomic variables, covering four markets including money market, the real economy, global factors and stock market. The money market is represented by inflation, interest rate, and MS; real economy is represented by exports, workers' remittances, and industrial production; global factors include the exchange rate and gold prices; while the stock market is represented by indexes (KSE-100 and KMI-30). Study period consists of 64 Months (07/11 to 10/16). Correlation, unit root, OLS regression and Granger causality tests are applied through EViews software.

Findings suggest that both markets (Islamic & conventional) are integrated with a selected group of macroeconomic indicators, during the period under review. A set of two variables (exports and workers' remittances) has shown links with both markets, while the third variable is different. For Islamic, this variable is industrial production; while for conventional market, it is MS. None of the indexes is linked with any of the global variables (exchange rate and gold prices), confirming the hypothesis of minor foreign influences on the PSX. Movements of Islamic index are in-line with the theory i.e., disassociation from interest and reflection of the real economy. Movements of the conventional index are linked with both the real economy and money market. However, evidence lacks the integration of markets themselves, surprisingly.

Rest of the study proceeds as follow: Section II reviews the literature to select macroeconomic variables, and develop hypothesises, followed by research methodology in Section III. Analysis and findings are reported in section IV, while the conclusion is offered in section V.

[1]Following the mergers of three stock exchanges (KSE, LSE and ISE) in 2016, it is now called PSX.

LITERATURE REVIEW

Asset pricing theory has gone through a dynamic process during the last century. Numerous models including Modern Portfolio Theory (MPT) (Markowitz, 1952), CAPM (Sharpe, 1964), APT (Ross, 1976), 3-Factor Model (Fama & French, 1992) and 4-Factor model (Carhart, 1997), etc. have been developed. The focus of these models has remained on the identification of relevant required rate of return on equity investments. MPT documents two critical aspects of the issueincluding quantification of risk (standard deviation), and risk-return relationship. CAPM introduced the concept of systematic and unsystematic risk and identified market beta as a measure of systematic risk. APT enlarged the concept of risk measures to multiple risk factors (however, quantity and identity were left to specific institutional settings). FF-3 factors contributed to the literature by replacing single risk factor of CAPM into three variablesmarket Beta, Size and book/market ratio. 4-factor model is built on 3-Factor by adding the fourth variable of momentum. Tracing multiple risk factors (APT) is more appealing than a single risk measure of CAPM. However, there is no uniform set of variables, globally, and one has to search for relevant risk factors in a particular market. Additionally, the relationship of variables changes over time. Hence, repeated efforts are needed to identify risk factors for the same market within a reasonable amount of time.

For this study, we have selected empirically tested variables, globally, as well as in the domestic marketincluding exchange rate, interest rate, MS, inflation, industrial production, gold pricesand two variables including exports and expat remittances, intuitively.

Selection of Variables

Following macroeconomic variables are selected for this study.

Exchange rate: Any movement in the exchange rate is expected to affect firms' cash flows, which are priced at the stock market. As the upward movement in the exchange rate is expected to increase revenue through sales in the international market [although increases costs of imports], hence, the expected relationship is positive through the trade channels. However, this is only one part of the effect of exchange rate movement on stocks prices. Another possibility of exchange rate affecting stock returns is through investment channel whereby depreciation in domestic currency reduces the stock returns for the foreign investors. Empirical evidence exists about the relationship between exchange rate and stock returns (e.g., Akash, Hasan, Javid, Shah, & Khan, 2011; Butt & Rehman, 2010; Mukherjee & Naka, 1995 at Japanese market; Kwon & Shin, 1999; and in domestic market studies include Hasan & Javed 2009; Hasan & Nasir, 2008; Mohammad, Hussain, Jalil, & Ali, 2009; Qayyum & Kemal 2006).

Inflation: Increase in inflation increases the cash flows for firms leading to higher prices of stocks and higher capital gains to investors. However, inflation also leads to higher cost of capital required by investors and higher risk-free rate, which consequently increases discount rate and reduces returns from the stocks. Adjustment process may be slow, while

input prices may increase earlier than the realisation of cash flows through output. An association is expected between inflation and the stock market. Empirical evidence about the relationship between inflation and stocks returns has been documented in many studies including Akash, et al. (2011), Al-Sharkas (2004), Chen et al. (1986), Gan, Lee, Yong, and Zhang (2006), Ibrahim and Aziz (2003), Mukharjee and Naka (1995), Patra and Poshakwale (2006), Roll and Ross (1980, 1984), while in the local market, Nishat and Shaheen (2004).

Interest rate: An upward movement in interest rate creates opportunities for investors to invest in debt securities, resulting in a decrease in stocks returns. Moreover, higher interest rate increases the cost of capital, leading to lower cash flows for firms. Signaling theory postulates that cash flows are priced by the market, which further strengthens the relationship between interest rate and stock returns. Interest rate variable has been used in many studies including Al-Sharkas (2004), Chen et al. (1986), Kwon and Shin (1999), Kyereboah-Coleman and Agyire-Tettey (2008), Mukherjee and Naka (1995), Srivastava (2010), and from domestic market, Rizwan and Khan (2007).

MS: MS is the total currency in circulation in the economy. Changes in the quantity of money could have a significant impact on the economic growth and development, resulting in variation in stocks prices. MS movements affect the purchasing power of consumers and cash flows for investors. It is expected that the increase in MS will increase inflation and hence cash flows to the firms enabling them to pay higher dividends, leading to more demand for stocks. Also, monetary expansion leads to lower interest rates, resulting in lower cost of capital leading to higher cash flows for firms. Moreover, lower interest rates shift investment from risk-free investment options to the stock market. Prior literature has documented the relationship between stock returns and MS including Al-Sharkas (2004), Chancharat, Valdakhani, and Havie (2007), Gan et al (2006), Ibrahim and Aziz (2003), Kandir (2008), Mukherjee and Naka (1995), Patra and Poshakwale (2006) and from the domestic market, Hasan and Nasir (2008).

Industrial production: Industrial production is expressed through the index Industrial Production Index (IPI) of manufacturing in the economy, updated monthly. It is used as a proxy for Gross Domestic Product (GDP) of the economy (as monthly data for GDP is not available) and depicts the overall economic activity in the country. As it is the proxy of national level output, hence a significant positive impact on stock returns is expected. Vast literature on the relationship of industrial production and stock returns exists (Akash et al. 2011; Al-Sharkas, 2004; Butt & Rehman, 2010; Ibrahim & Aziz, 2003; Kvon & Shin, 1999; Mukherjee & Naka, 1995; and from domestic market, Hasan & Javed, 2009; Hasan & Nasir, 2008; Nishat & Shaheen, 2004).

Workers' remittances: Foreign remittances represent the inflow of foreign currency remitted by expatriates to their families and relatives that enhance purchasing power, substantially, in the domestic market. The cash flows might be used for investment in the stock

market; while the indirect impact on stock returns, through increased demand for goods and services, cannot be denied. Given the increased purchasing power, a positive relationship is expected. The inclusion of this variable in this study is encouraged by the fact that there has been a substantial increase in foreign remittances during the study period (Ministry of Finance, 2016).

Exports: Increased exports mean more economic activity in the domestic market. Higher economic activity leads to overall prosperity and increased purchasing power in the society. Businesses flourish and income of residents' increases, resulting in savings; hence capital formation takes place. Additional capital is expected to be invested directly/indirectly, which increases demand for equity securities, resulting in higher prices of the stocks and more returns. Besides, higher exports increase cash flows to the firms which are positively priced at stock market.

Gold prices: Gold prices have shown tremendous variations in recent years, and this sector has become an alternative market for investors. It is expected that the gold market can be used for diversification of portfolios leading to a relationship with stocks returns. Gold prices turned significant in the study of Muhammad, Lal, Naqvi, and Zehra (2012).

The studies focused on the integration of Islamic capital markets with macroeconomic indicators are modest as compared to conventional stocks, given the infancy of Islamic capital market. However, following studies are worth mentioning: Yusof et al. (2007) examined Malaysian market for the period 1992-2000, through the application of Generalized Autoregressive Conditional Heteroskedasticity (GARCH) (1,1). They found that interest rate volatility affects conventional market, but not the Islamic stock market. Hussin et al. (2012) conducted a study on Malaysian Islamic stock market through VAR method for the period 1999-2007 and documented that market was cointegrated with IPI, Consumer Price Index (CPI), MS and exchange rate. Majid and Yusof (2009) documented results on Malaysian Islamic stock market through the application of ARDL method for the period 1997-2006. As per findings, exchange rate, MS and interest rate were found significant explanatory of the stock returns. Rana and Akhter (2015) documented evidence from Pakistan's market by application of GARCH-M covering the period 2008-13. Results show that determinants were different for the conventional and Islamic market. As per findings, KMI-30 was affected by exchange rate only, while KSE-100 received impact from interest rate as well as the exchange rate.

Selected variables for testing have been identified through literature review and/or widely accepted theories and proven their worthin domestic as well as global markets. However, the sample is unique, as not too many studies have been conducted on Sharī'ah-compliant securities. Hence, the literature lacks sufficient evidence about the risk factors of Sharī'ah-compliant stocks returns. It is expected that this study will uncover important macroeconomic variables contributing to stock returns variation process at PSX.

Institutional Settings

At the beginning of 2016, PSX was formed by merging KSE (1947), Lahore Stock Exchange (LSE) (1970), and Islamabad Stock Exchange (ISE) (1989). In the first decade of 21st century, KSE displayed tremendous performance and declared the best-performing stock exchange in 2002 (Ahmad, 2003; Dawn, 2002); in addition, PSX was announced as Asia's 3rd best-performing equity market in 2016 (Verhage, 2016). In Pakistan, Islamic financial services are expanding nationwide; and by the end of September 2016, the number of Banking Institutions, offering Islamic financial services, reached 22 with the branch network of 2,266. Total assets of Islamic banking industry amounted to PKR1,788 billion (US$18 billion approximately) covering almost 12% of domestic market share whereas Islamic finance grew at 28% per annum during 2008-13 (SBP, 2016a). Islamic Index (KMI-30), launched in 2008, serves as a benchmark for Sharī'ah-compliant investment portfolios. For a security, to be "Sharī'ah-compliant" based on KMI-30 Criterion, it must meet the six key tests.

- The core business of the firm must not be *ḥarām* (unlawful as per Sharī'ah)
- Interest-based leverage up to 37%
- *Ḥarām* investments up to 33%
- Liquid assets up to 75% (all ratios based on total assets; leverage and liquidity tests improved over time from 40% and 80%),
- *Ḥarām* income up to 5% of total revenue; and
- Net liquid asset/market value is less than one (Al-Meezan, n.d).

Development of Islamic index in Pakistan led to the incorporation of Islamic mutual funds. By the end of June 2016, above 80 funds including equity and money market, with an asset volume of PKR 158 Billion, covering 33% of market share, were operating in the domestic market (MUFAP, 2016). With the introduction of screening for Sharī'ah-compliance of securities, listed on PSX, investment opportunities for Islamic financial industry have improved.

Hypotheses

Based on the literature, cited above, following hypotheses are proposed for testing. Empirics suggest market integration with macroeconomic variables, globally, with both types of markets including Islamic and conventional. Hence, we hypothesize the following:

H1: Macroeconomic variables and Stock marketsconventional and Islamic are integrated.

As currently being practiced, Islamic capital market is a subset of the broader conventional market, with a reduced number of securities; hence, the integration of both markets is expected, which leads to the following hypothesis:

H2: Conventional and Islamic stock markets are integrated.

Although, Islamic capital market is subset of broader conventional market, with a reduced stock universe, yet few important sectors are absent in composition of Islamic capital market including firms engaged in *ḥarām* (unlawful as per Islamic law) businesses; conventional financial sector (banking, insurance, finance companies and mutual funds); corporations with dual operations *ḥalāl* and *ḥarām* (beyond a certain limit); highly levered firms; and service organizations (failing liquidity limit test). These facts lead us to believe that the Islamic mar-

ket is expected to show more links with the real sector; while conventional market equally treats the real and financial sectors. Also, it is expected that Islamic capital market will show disassociation with interest rate due to filtration of highly levered firms and conventional financial sector. As for global variablesgold prices and exchange rateare concerned, traditionally, Pakistani market has not shown much response to international events; however, the impact can be equal on both marketsconventional and Islamic. Empirics support the difference in the associated group of variables (Rana & Akhter, 2015). Hence, we hypothesize:

H3: The Integrated group of macroeconomic variables is different for conventional and Islamic stock markets.

METHODOLOGY

Data and Proxies

The theoretical framework, depicting two-way causation, is presented in Figure-1. Islamic stock market is represented by KMI-30 index, while KSE-100 is proxy for the conventional capital market. Money market variables include MS, interest rate and inflation; the real sector is represented by industrial production, exports, and workers' remittances; and global variables include the exchange rate and gold prices. Data for all the time series are extracted from the statistical bulletins of the State bank of Pakistan (SBP, 2016b) except KSE-100 index (Yahoo Finance, 2017) and gold prices (Bullion Rates)[2]. Our study period covers 64 months (07/2011-10/2016). Islamic capital market index started operation in 2008; however, in the initial period, the Islamic finance market was at infant stage; hence, we started to study from 2011 onward.

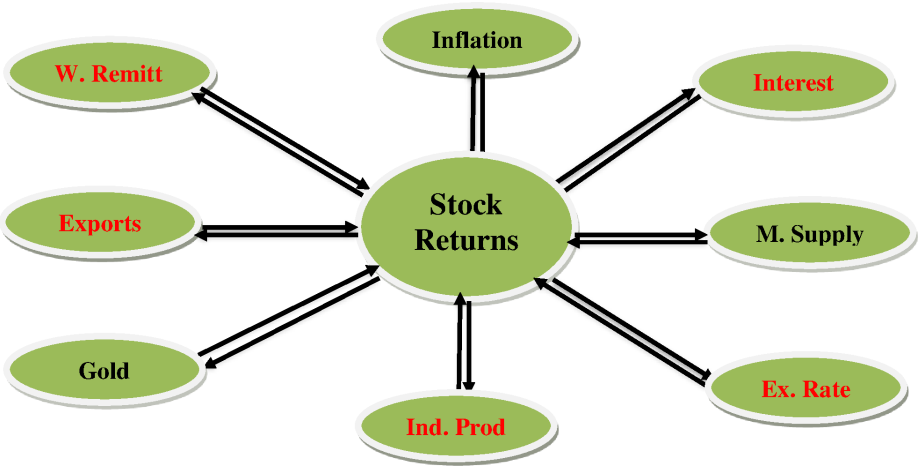

FIGURE 1. Theoretical framework [Causality model]

Proxies for econometric analysis of each of the selected variables are calculated as under:

1. Three types of inflation indexes are available in Pakistan including Sensitive Price Index (SPI), CPI and Wholesale Price Index (WPI). For this study, CPI is selected as a proxy

[2]http://www.bullion-rates.com/gold/PKR/2016-12-history.ht[Accessed 1st February 2017]

for inflation on account of more inclusiveness due to its general acceptability as inflation measure.

2. Many currencies' exchange rates are available, and we have to make a choice. US$ being reserve currency is used as representative of the foreign exchange rate for this study. Exchange rate proxy is calculated in terms of the value of ONE US$ in domestic currency, i.e., Pakistani rupees (PKRs).

3. There are many types of interest rate including treasury rates, lending rates, and deposit rates. For this study, Karachi Inter Bank Offered Rate (KIBOR) is selected as a proxy for interest rate variable on account of following reasons. First, this rate contributes to determining the financing rate to the private sector, used in the weighted average cost of capital and also determines the private sector bonds market rate. Second, more accurate data for KIBOR is available (being a single rate of the banking sector) than lending or deposit rate.

4. IPI data is updated monthly by the State Bank of Pakistan. Although using IPI as a proxy for GDP is questioned very rightly by certain quarters as in the domestic market, the share of large-scale manufacturing is about a quarter; however, as no other variable is available to proxy the GDP, hence, we have to rely on this.

5. There is a single figure of workers' remittances updated monthly by the central bank of Pakistan, which is used as a proxy in this study.

6. MS has been broadly classified as M2 and M1, where M1 includes all physical money such as coins and currency also including demand deposits, while M2 includes M1 and all time-related deposits, saving deposits, and non-institutional money-market funds. For this study, M2 is selected, being a true/better representative of monetary expansion, as a proxy for MS.

7. There is a single figure of exports updated monthly by the central bank of Pakistan that is used as a proxy in this study.

8. Bullion rates per gram in PKR are used as a proxy for gold prices.

9. KMI-30 is the country index of Islamic capital market in the local market, and we used it as a proxy.

10. There are three indexes, updated daily at PSX, including KSE-All shares, KSE-100 and KSE-30. We selected the KSE-100 index, being comprehensive, as a proxy for this study.

Econometric Techniques

For data analysis and results, we applied descriptive statistics, correlation, stationarity (unit root), OLS-regression and Granger Causality tests. Analysis has been conducted through MS-Excel and EViews9 software.

Descriptive statistics: Descriptive statistics are used to study fundamental features of variables; such as mean, median, standard deviation a measure of dispersion; skewness a measure of symmetry; and Kurtosis, Jarque-Beratests of normality.

Multicollinearity: Correlation is calculated to understand the mutual relationship of log-returns of sample indexes. Correlation is although a weak technique to document relationship, as it is not causation, (hence we used Granger causality), yet it has an essential place in econometrics to have a basic feel about the relationship of underlying series. In addition, independent variables with significant mutual correlation may lead to spurious results in a regression model.

Stationarity check: To conduct regression and Granger causality analysis, stationarity of time series at the same order of integration is required. Therefore, we need to check the unit root in time series. Literature suggests two types of unit root tests, including individual series unit root testing (DF-1979, 1981; PP-1988) and latest developments of group unit root testing (Fisher-ADF, and Fisher-PP-1999, 2001). We preferred group unit root test-Fisher-ADF because of better power than individual series tests. Panel/group unit root tests are similar, but not identical, to unit root tests carried out on individual series. We selected Fisher-ADF group unit root test (Maddala & Wu, 1999), for this study to cater individual as well as group results. Fisher-ADF allows for individual unit root processes so that may vary across cross-sections. Fisher-ADF group unit root test combines individual unit root tests to derive a group-specific result (Asteriou & Hall, 2015; IHS, 2013) [see details in the appendix].

To obtain determinants of stock returns from macroeconomic variables, we rely on regression analysiswith market returns taken as dependent variables and macroeconomic series independent variables. To study both-way causation, Granger causality is applied.

Regression analysis: To meet the requirement of stationarity, raw data converted into logarithmetic series by the application of the following formula:

$$R_t = ln(\frac{P_t}{P_{t-1}}) \tag{1}$$

ln is natural log; R_t is return in month t; P_t is the price of month t; P_{t-1} is the price in the previous month. To document the evidence about the impact of independent variables on the dependent variable, OLS-regression technique is applied by using the EVeiws-9 software.

Following are our basic econometric models used in regression analysis by following general to specific techniques. [For details, see appendix].

$$(KMI_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(IR_t) + b_4(IP_t) + b_5(EX_t) + b_6(WR_t) + b_7(MS_t) + b_8(GP_t) + e_t \tag{2}$$

$$(KSE_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(IR_t) + b_4(IP_t) + b_5(EX_t) + b_6(WR_t) + b_7(MS_t) + b_8(GP_t) + e_t \tag{3}$$

Whereby: (KMI_t)= Islamic Capital market, (KSE_t) = Conventional Stock market, a = Intercept (Constant), b = Beta coefficient XR = Exchange rate, PI = Inflation (price index), IR = Interest rate, IP = Industrial production, WR = Remittances of expatriates, MS = Money supply, GP = Gold prices, EX = Exports, e = Error term

Granger causality: Correlation signifies the direction of the relationship, but results are elementary and do not depict causation, necessarily. We are interested in causality and lead-lag relationship; Granger Causality is the most widely used technique to determine this relationship. Accordingly, y is said to be Granger-caused by x if x helps in the prediction of y. If x Granger causes y and y Granger causes x, that is the case of two-way causation. Model is applied on stationary series, after converting prices into log returns. Following basic model is used to test causality in this study [details in the appendix]:

$$y_t = a_0 + \sum_{i=1}^{n} a_i y_{t-i} + \sum_{j=1}^{m} b_i x_{t-i} + \varepsilon_t \quad (4)$$

So on, for all (8+1) variables 17-pairs and 34-models, for both indexes. The reported F-statistics are the Wald statistics for the joint hypothesis: $b_1 = b_2 = ...b_j = 0$; for each equation. The null hypothesis is that x does not Granger-cause y. In this study we selected 4-lags, given the monthly data, as suggested in theorymore is better (Asteriou & Hall, 2015; IHS, 2013).

RESULTS & DISCUSSION

Descriptive Statistics

Descriptive statistics are calculated to understand the nature of data and results are presented in Table 1. As per results, average monthly returns are most for KMI and KSE (about 2% monthly) followed by MS (about 1%). KIBOR, gold prices and exports have negative average monthly change, clearly signifying opposite direction. CPI, IPI, WR and XR monthly changes are less than 1/2%. Median values of all series, except CPI, are far from average, signifying issues of outliers in the data. Standard deviation is highest for workers' remittances, followed by exports and IPI. Majority of skewness statistics with negative signs, shows that series are bent to the left side of Mean. Overall, differenced data is not much dispersed, with fat tales, as depicted by low values of skewness and standard deviations. Like average, the standard deviations of both indexes (Islamic and conventional) are very close to each other. All Kurtoses except KIBOR and exchange rate are close to the critical value of 03, showing normality in differenced series, relatively, while KIBOR and exchange rate distribution is leptokurtic. According to the Jarque-Bera test of normality, two series including KIBOR and exchange rate are out of normality circle.

TABLE 1
Descriptive Statistics

Description	CPI	EX $	GP	IPI	KIBOR	KMI-30	KSE-100	MS PK	WR $	XR $/PKR
Mean	0.004	-0.002	-0.000	0.002	-0.012	0.018	0.018	0.010	0.005	0.003
Median	0.004	-0.004	-0.002	-0.010	-0.001	0.024	0.027	0.007	0.028	0.001
Std. Deviation	0.007	0.093	0.054	0.068	0.042	0.045	0.048	0.017	0.128	0.012
Skewness	-0.035	0.300	0.153	0.405	-1.148	-0.143	-0.402	0.334	-0.571	-0.913
Kurtosis	2.428	2.957	2.580	4.121	8.011	2.885	3.266	2.236	3.300	8.349
Jarque-Bera	0.869	0.955	0.709	5.029	79.772	0.251	1.892	2.706	3.661	83.869
Probability	0.647	0.620	0.709	0.080	0.000	0.881	0.388	0.258	0.160	0.00

Data Trends

Trends in the series are presented in Figure 2. Panel-A (Figure 2) displays trends in series at log values. According to graphs, inflation, Islamic capital market, the conventional stock market, MS, workers' remittances, industrial production and exchange rate series display an upward trend during the study period. The interest rate, exports and gold prices have shown downward trends. Trends in differenced series (log returns) are presented in Panel-B (Figure 2) indicating very close to random walk.

FIGURE 2. Data trends

Multicollinearity

Correlation results are presented in Table 2. Out of 45 pairwise correlation results, 25 are negative (CPI-EX, CPI-IPI, CPI-KIBOR, CPI-MS, CPI-WR, EX-GP, EX-KIBOR, EX-XR, GP-IPI, GP-KIBOR, GP-KMI, GP-KSE, GP-MS,GP-WR, IPI-KMI, IPI-KSE, KIBOR-KMI, KIBOR-MS, KIBOR-WR, KIBOR-XR, KMI-MS, KMI-WR, KMI-XR, KSE-MS, KSE-WR, KSE-XR). Highest positive correlation (94%) is found between conventional and Islamic capital markets (KSE-KMI), followed by exports and workers' remittances (59%), while least correlation (0.00) is found between Interest rate and conventional capital market (KIBOR-KSE); and between Islamic capital market and workers' remittances (KMI-WR). The highest negative correlation (-51%) is found between industrial production and inflation (IPI-CPI), followed by inflation and MS [CPI-MS] (-33%). Overall, a weak correlation is found among time series, as only 03 (06) pairs could cross the figure of 50% (33%), respectively. Correlation of macroeconomic variables with stock markets is very low (less than 25%). However, the correlation between conventional and Islamic stock markets is very high (94%).

TABLE 2
Correlation

Description	CPI	EX	GP	IPI	KIBOR	KMI	KSE	MS	WR
CPI	1.00								
Export	-0.27	1.00							
Gold Price	0.22	-0.12	1.00						
IPI	-0.51	0.43	-0.07	1.00					
KIBOR	-0.02	-0.03	-0.08	0.07	1.00				
KMI	0.24	0.02	-0.02	-0.13	-0.05	1.00			
KSE	0.18	0.04	-0.12	-0.14	0.00	0.94	1.00		
MS	-0.33	0.26	-0.17	0.19	-0.08	-0.13	-0.10	1.00	
WR	-0.08	0.59	-0.05	0.18	-0.16	-0.00	-0.06	0.33	1.00
XR	0.02	-0.06	0.10	0.04	-0.10	-0.21	-0.20	0.11	0.01

Stationarity Check

Results of group unit root tests on the level as well as the first difference are presented in Table 3. As per results, all log series have trends at the level, as depicted by probability valuesranging from 0.2 to 0.79. In addition, summary statistics of ADF-Fisher Chi-square (ADF-FC) and ADF-Choi Z-stat (ADF-CZ) are also insignificant. However, differenced series are stationary at 1% significance level, as depicted by probability values of ADF-FC, ADF-CZ, as well as, individual series. In our sample order of integration of all selected series is I(1); hence, our sample data is ready for regression analysis and Granger causality at differenced series (log returns).

TABLE 3
Unit root testing

Variables	At Level		At First Difference		Results
	Statistics	Probability	Statistics	Probability**	
Group Testing					
ADF-Fisher Chi-square	14.31	0.81	384.45	0.00	I(1)
ADF-Choi Z-stat	0.37	0.64	-17.59	0.00	I(1)
Individual Series					
KIBOR		0.60		0.00	I(1)
Inflation-CPI		0.20		0.00	I(1)
Export-EX		0.55		0.00	I(1)
Gold Prices-GP		0.30		0.00	I(1)
Industrial Production-IPI		0.79		0.00	I(1)
Islamic Capital Market-KMI		0.76		0.00	I(1)
Conventional Market-KSE		0.76		0.00	I(1)
MS		0.68		0.00	I(1)
Workers' remittances-WR		0.59		0.00	I(1)
Exchange rate-XR		0.21		0.00	I(1)

** Probabilities for Fisher tests are computed using an asymptotic Chi-Square distribution.
All other tests assume asymptotic normality

Regression Results

OLS regression applied to differenced data (geometric series) and results are presented in Table 4 & 5. Given a large number of regressors (8 macroeconomic variables), we followed the procedure '*in general to specific*' (deduction method). In total, we used seven regression models for both conventional and Islamic indexes [see appendix]. Model-1 included all variables and based on *t* stats and *p* values; we eliminated insignificant variables one by one.

In the case of KMI-30, we started with the CPI to exchange rate, exports, KIBOR, gold prices, MS, workers' remittances and IPI. Accordingly, IPI, WR, MS, GP, KIBOR and EX eliminated through models 2.0-2.5. We recommend model 2.6 based on data during the period under review for pricing of Islamic index. In our suggested model, the adjusted R^2 value is 7.2% with Durban-Watson Stat of 2.4 and probability of *F*-Stat 3%.

TABLE 4
Regression Results KMI-30

Model#	$Ad - R^2$	CPI	XR	EX	IR	GP	MS	WR	IPI
	D-W Stat	*t* Stat	*t* Stat	*t* Stat	*t* Stat	*t* Stat	*t* Stat	*t* Stat	*t* Stat
	(Prob-*F* Stat)	(*p* Value)	(*p* Value)	(*p* Value)	(*p* Value)	(*p* Value)	(*p* Value)	(*p* Value)	(*p* Value)
Model-2.0	-0.0117	1.480	-0.766	0.055	-0.084	-0.048	-0.133	-0.016	-0.016
8-Vrbls.	2.333	1.572	-1.537	0.648	-0.597	-0.433	-0.360	-0.278	-0.151
	(0.51)	(0.12)	(0.13)	(0.51)	(0.55)	(0.66)	(0.71)	(0.78)	(0.88)
Model-2.1	0.006	1.544	-0.774	0.514	-0.086	-0.050	-0.131	-0.016	
7-Vrbls.	2.329	1.853	-1.576	0.640	-0.620	-0.449	-0.358	-0.274	

*Significant at 10%; and **Significant at 5%

Table 4 Continue...

Model#	$Ad-R^2$ D-W Stat (Prob-F Stat)	CPI t Stat (p Value)	XR t Stat (p Value)	EX t Stat (p Value)	IR t Stat (p Value)	GP t Stat (p Value)	MS t Stat (p Value)	WR t Stat (p Value)	IPI t Stat (p Value)
	(0.40)	(0.06)*	(0.12)	(0.52)	(0.53)	(0.65)	(0.72)	(0.78)	
Model-2.2	0.022	1.506	-0.776	0.038	-0.080	-0.050	-0.156		
6-Vrbls.	2.337	1.848	-1.593	0.594	-0.591	-0.457	-0.444		
	(0.30)	(0.06)*	(0.11)	(0.55)	(0.55)	(0.64)	(0.65)		
Model-2.3	0.036	1.599	-0.806	0.033	-0.075	-0.044			
5-Vrbls.	2.376	2.045	-1.681	0.522	-0.559	-0.410			
	(0.21)	(0.04)**	(0.09)*	(0.6)	(0.57)	(0.68)			
Model-2.4	0.050	1.538	-0.824	0.034	-0.071				
4-Vrbls.	2.367	2.018	-1.739	0.553	-0.535				
	(0.13)	(0.04)**	(0.08)*	(0.58)	(0.59)				
Model-2.5	0.061	1.551	-0.799	0.036					
3-Vrbls.	2.382	2.048	-1.704	0.583					
	(0.08)*	(0.04)**	(0.09)*	(0.56)					
Model-2.6	0.072	1.433	-0.814						
2-Vrbls.	2.399	1.975	-1.750						
	(0.03)**	(0.05)**	(0.08)*						

*Significant at 10%; and **Significant at 5%

TABLE 5
Regression Results KSE-100

Model#	$Ad-R^2$ D-W Stat (Prob-F Stat)	CPI t Stat (p Value)	XR t Stat (p Value)	EX t Stat (p Value)	IR t Stat (p Value)	GP t Stat (p Value)	MS t Stat (p Value)	WR t Stat (p Value)	IPI t Stat (p Value)
Model-3.0	-0.007	1.256	-0.682	-0.126	0.104	-0.053	-0.068	-0.030	-0.076
8-Vrbls.	2.289	1.276	-1.308	-1.079	1.157	-0.862	-0.604	-0.205	-0.196
	(0.48)	(0.20)	(0.19)	(0.28)	(0.25)	(0.39)	(0.54)	(0.83)	(0.84)
Model-3.1	0.010	1.308	-0.695	-0.124	0.103	-0.056	-0.068	-0.029	
7-Vrbls.	2.305	1.393	-1.357	-1.073	1.163	-0.948	-0.603	-0.199	
	(0.38)	(0.16)	(0.18)	(0.28)	(0.24)	(0.34)	(0.54)	(0.84)	
Model-3.2	0.027	1.300	-0.686	-0.122	0.103	-0.054	-0.070		
6-Vrbls.	2.313	1.397	-1.356	-1.069	1.169	-0.936	-0.632		
	(0.27)	(0.16)	(0.18)	(0.28)	(0.24)	(0.35)	(0.52)		
Model-3.3	0.037	1.568	-0.716	-0.127	0.084	-0.052			
5-Vrbls.	2.315	1.904	-1.431	-1.121	1.020	-0.899			
	(0.21)	(0.06)*	(0.15)	(0.26)	(0.31)	(0.37)			
Model-3.4	0.040	1.491	-0.744	-0.127	0.040				
4-Vrbls.	2.345	1.824	-1.490	-1.121	0.606				
	(0.17)	(0.07)*	(0.14)	(0.26)	(0.54)				
Model-3.5	0.050	1.367	-0.759	-0.131					
3-Vrbls.	2.354	1.737	-1.531	-1.165					
	(0.10)*	(0.08)*	(0.13)	(0.24)					
Model-3.6	0.045	1.169	-0.819						
2-Vrbls.	2.318	1.517	-1.655						
	(0.09)*	(0.13)	(0.10)*						

*Significant at 10%; and **Significant at 5%

This model gives better and improved results, over any other model, as depicted in Table 4. For example, the probability value of F-Stat was 0.51 in model-2.0 which reduced to 0.03 in model-2.6. Two variables are significant including CPI with the positive coefficient at 5% and the exchange rate with a negative coefficient at 10%. These results are in-line with findings of Hussin et al. (2012). CPI's significance and KIBOR's insignificance in the pricing of Islamic index is apparently in line with the theory of Islamic finance. Although Islamic investors are not interested in earning interest, they can be motivated for investment only if the return on investment covers at least inflation during the period.

In the case of KSE-100, we started with the CPI, exchange rate, gold prices, exports, workers' remittances, IPI, KIBOR and MS. We eliminated gold prices, exports, workers' remittances, IPI, KIBOR and MS based on t stat and p values through Models 3.0-3.5. In case of a conventional stock index, none of the variables is significant except exchange rate at 10% significance level. In model-3.6, the value of adjusted R^2 is just 4.5% with the Durban-Watson stat of 2.3 and probability of F-Stat 9%. The significance (at 10%) of the exchange rate suggests that the market is being affected by external factors, relatively.

TABLE 6
Pairwise Granger Causality Tests

Stock Market	Causation	Macroeconomic Variables	F-Stat ≫	Probability ≫	F-Stat ≪	Probability ≪
Panel-A: KMI						
KMI	==========	CPI	0.91	0.46	0.49	0.74
KMI **	⋘ ==========⋙	**Exports	4.33	0.00	4.51	0.00
KMI	==========	Gold Prices	0.41	0.79	0.96	0.43
KMI *	==========⋙	Industrial Production	2.48	0.05	2.10	0.09
KMI	==========	Interest Rate	0.35	0.83	0.49	0.73
KMI	==========	KSE	0.17	0.94	0.01	0.99
KMI	==========	MS	2.17	0.08	1.75	0.15
KMI *	==========⋙	Expat Remittances	2.71	0.04	1.85	0.13
KMI	==========	Exchange Rate	0.53	0.71	0.55	0.69
Panel-B: KSE						
KSE	==========	Inflation	0.80	0.53	0.40	0.80
KSE *	⋘==========⋙	**Exports	3.21	0.02	5.26	0.00
KSE	==========	Gold Prices	0.42	0.79	0.62	0.64
KSE	==========	Industrial Production	1.89	0.12	2.06	0.09
KSE	==========	Interest Rate	0.15	0.96	0.75	0.56
KSE *	==========⋙	MS	2.82	0.03	1.17	0.33
KSE **	==========⋙	Expat Remittances	3.99	0.00	1.88	0.12
KSE	==========	Exchange Rate	0.43	0.77	0.64	0.631

**, * Denotes rejection of the hypothesis at the 0.01 and 0.05 level (with Lags:4)

Causal Relationship

Granger Causality test has been conducted on stationary series (log-returns) to determine the direction of the relationship between stock markets and macroeconomic variables, during the period under review and results are presented in Table 6. We selected 4-lags, given the monthly data, as suggested in theorymore is better; and we assume four months is a sufficient period for prediction of a variable by another. In the case of the Islamic capital market, three variablesexports, industrial production, and workers' remittancesare significant at 5% level. Volatility spills have been observed from Islamic capital market to exports, industrial production and workers' remittances, while variations in exports had an impact on the Islamic capital market, during the study period. So in the case of exports, bi-directional

volatility is found. Islamic capital market has shown strong links with the real economy. Three variablesincluding exports, MS, and workers' remittancesare linked with the conventional stock market, significantly (at 5%). Export causes variations in the stock market, while volatility spills from the stock market to exports, MS, and workers' remittances. Two-way causality is found in the case of exports. Results depict integration of conventional index with both real and monetary sectors. Overall, the results indicate the reflection of the real sector in the stock market, during the period under review. Surprisingly, Islamic and conventional indexes do not Granger causes each other, during the period under review, although correlation results are different.

Summary Findings

Results of regression analysis and Granger causality are different. In the case of regression, the significance level is high, as well as, the value of adjusted *R* Square is shallow. Hence, we base our findings and conclusions on Granger causality results. Based on these results, we document following significant findings leading to acceptance/rejection of the hypotheses.

1. Stock market indexes are linked with macroeconomic indicators, especially; real sector activities are reflected at market-index movements, during the period under review.

2. Conventional and Islamic capital markets are not integratedoffer diversification opportunities for portfolio managers, within the national borders. Although, correlation is high, yet, causation is not proven under Granger causality.

3. The conventional stock market index is reflective of both real and monetary sectors (linked with exports, MS, and workers' remittances) during short-run variations in the economy.

4. Islamic index is reflective of the real economy (linked with exports, industrial production, and workers' remittances) during the period under review.

5. Two of the three integrated variables are same for conventional and Islamic capital markets, in the short run, while the third variable is different for both (from the monetary sector in case of the conventional market; and from the real sector in the case of Islamic capital market).

6. Global variables (gold prices and exchange rate) remained insignificant during the study period. Two important money market variables (interest rate and inflation) also turned insignificant, during the period under review.

Based on these findings, we cannot reject hypothesis # 1 the integration of markets with macroeconomic indicators, during the study period. We cannot accept hypothesis # 2integration of conventional and Islamic capital markets (in the short run). In the case of the third hypothesis the difference in the list of integrated macroeconomic serieswe find a difference in the set of integrated variables. Hence, we cannot reject hypothesis # 3.

CONCLUSION

In this study, we investigated important macroeconomic variables integrated with stocks returns' for conventional and Islamic indexes, in the Pakistani market, from 2011-16. We selected eight macroeconomic variablesCPI, exchange rate, gold prices, exports, workers' remittances, IPI, KIBOR and MS. The objective was to document the causation among macroeconomic variables and stock market indexesconventional and Islamiccomparatively, in the domestic market to uncover whether Sharī'ah screening has made any difference in the associated variables (risk factors).

Through the application of Granger causality test, we conclude that both indexes (conventional and Islamic) are integrated with macroeconomic indicators; especially real sector activities are reflected in the movements of stock market indexes. Both market indexes are not integrated, mutually, in the short run. Although the majority of integrated variables with market indexes are same; however, Islamic market index turned out to be more representative of the real sector, while the conventional market index is linked with both, real and monetary sectors, in the short run. Global variablesgold prices and exchange ratehave not shown any significant association with the domestic stock market.

Findings of the study are helpful for policymaking bodies and investors. These findings carry an essential message for fast-growing Islamic financial services industry, especially, Islamic mutual funds, within the economy as well as within the region. Investors need to have eyes on the real sector (industrial production, exports, and workers' remittances), while selecting stocks in the Pakistani market. Our recommendations to investors and portfolio managers include tapping selected diversification opportunities within conventional and Islamic markets. We also recommend to policymakers for facilitation of industrial production, exports, and expat remittances as well as effective management of MS and increased transparency in the stock market. Also, we recommend a balanced monetary policy, as we noted that important monetary variablesinterest rate and inflationare not integrated with market indexes, during the period under review. Equally, the study contributes to the overall understanding of academia and the general public about a market with dual indexesconventional and Islamic.

Limitations of the study include, relatively, small study period (64 months). Future research agenda includes testing long-run cointegration of stock market with macro economy as well as the impact of fundamentals on stocks returns at the PSX.

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APPENDIX

Regression Models

Following are our econometric models used in regression analysis by following general to specific techniques. While starting with eight variables, in the case of ICM, we excluded insignificant variables one by one based on *t* statistics and *p* values.

$$(KMI_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(IR_t) + b_4(IP_t) + b_5(EX_t) + b_6(WR_t) + b_7(MS_t) + b_8(GP_t) + e_t \quad (2)$$

After deleting IPI,

$$(KMI_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(IR_t) + b_4(EX_t) + b_5(WR_t) + b_6(MS_t) + b_7(GP_t) + e_t \quad (2.1)$$

After deleting IPI, and WR

$$(KMI_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(IR_t) + b_4(EX_t) + b_5(MS_t) + b_6(GP_t) + e_t \quad (2.2)$$

After deleting IPI, WR, and MS

$$(KMI_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(IR_t) + b_4(EX_t) + b_5(GP_t) + e_t \quad (2.3)$$

After deleting IPI, WR, MS, and GP

$$(KMI_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(IR_t) + b_4(EX_t) + e_t \quad (2.4)$$

After deleting IPI, WR, MS, GP, and IR

$$(KMI_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(EX_t) + e_t \quad (2.5)$$

After deleting IPI, WR, MS, GP, IR, and EX

$$(KMI_t) = a_t + b_1(XR_t) + b_2(PI_t) + e_t \quad (2.6)$$

While in case of KSE-100, following models tested, following general to specific approach.

$$(KSE_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(IR_t) + b_4(IP_t) + b_5(EX_t) + b_6(WR_t) + b_7(MS_t) + b_8(GP_t) + e_t \quad (3)$$

After deleting MS,

$$(KSE_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(IR_t) + b_4(IP_t) + b_5(EX_t) + b_6(WR_t) + b_7(GP_t) + e_t \quad (3.1)$$

After deleting MS, and IR

$$(KSE_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(IP_t) + b_4(EX_t) + b_5(WR_t) + b_6(GP_t) + e_t \quad (3.2)$$

After deleting MS, IR, and IPI

$$(KSE_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(EX_t) + b_4(WR_t) + b_5(GP_t) + e_t \quad (3.3)$$

After deleting MS, IR, IPI, and WR

$$(KSE_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(EX_t) + b_4(GP_t) + e_t \quad (3.4)$$

After deleting MS, IR, IPI, WR, and EX

$$(KSE_t) = a_t + b_1(XR_t) + b_2(PI_t) + b_3(GP_t) + e_t \quad (3.5)$$

After deleting MS, IR, IPI, WR, EX, and GP

$$(KSE_t) = a_t + b_1(XR_t) + b_2(PI_t) + e_t \quad (3.6)$$

Causality Models

Following models are used to test causality in this study:

$$y_t = a_0 + \sum_{i=1}^{n} a_i y_{t-i} + \sum_{j=1}^{m} b_j x_{t-j} + \varepsilon_t \quad (4)$$

Islamic capital market and Inflation.

$$KMI_t = a_0 + \sum_{i=1}^{4} a_i KMI_{t-i} + \sum_{j=1}^{4} b_j CPI_{t-j} + \varepsilon_t \quad (4.1)$$

$$CPI_t = a_0 + \sum_{i=1}^{4} a_i CPI_{t-i} + \sum_{j=1}^{4} b_j KMI_{t-j} + \varepsilon_t \quad (4.2)$$

Islamic capital market and Exports

$$KMI_t = a_0 + \sum_{i=1}^{4} a_i KMI_{t-i} + \sum_{j=1}^{4} b_j EX_{t-j} + \varepsilon_t \quad (4.3)$$

$$EX_t = a_0 + \sum_{i=1}^{4} a_i EX_{t-i} + \sum_{j=1}^{4} b_j KMI_{t-j} + \varepsilon_t \quad (4.4)$$

Islamic capital market and Gold prices

$$KMI_t = a_0 + \sum_{i=1}^{4} a_i KMI_{t-i} + \sum_{j=1}^{4} b_j GP_{t-j} + \varepsilon_t \quad (4.5)$$

$$GP_t = a_0 + \sum_{i=1}^{4} a_i GP_{t-i} + \sum_{j=1}^{4} b_j GP_{t-j} + \varepsilon_t \quad (4.6)$$

Islamic capital market and Industrial production

$$KMI_t = a_0 + \sum_{i=1}^{4} a_i KMI_{t-i} + \sum_{j=1}^{4} b_j IPI_{t-j} + \varepsilon_t \quad (4.7)$$

$$IPI_t = a_0 + \sum_{i=1}^{4} a_i IPI_{t-i} + \sum_{j=1}^{4} b_j KMI_{t-j} + \varepsilon_t \quad (4.8)$$

Islamic capital market and interest rate

$$KMI_t = a_0 + \sum_{i=1}^{4} a_i KMI_{t-i} + \sum_{j=1}^{4} b_j IR_{t-j} + \varepsilon_t \quad (4.9)$$

$$IR_t = a_0 + \sum_{i=1}^{4} a_i IR_{t-i} + \sum_{j=1}^{4} b_j KMI_{t-j} + \varepsilon_t \quad (4.10)$$

Islamic capital market and conventional capital market

$$KMI_t = a_0 + \sum_{i=1}^{4} a_i KMI_{t-i} + \sum_{j=1}^{4} b_j KSE_{t-j} + \varepsilon_t \quad (4.11)$$

$$KSE_t = a_0 + \sum_{i=1}^{4} a_i KSE_{t-i} + \sum_{j=1}^{4} b_j KMI_{t-j} + \varepsilon_t \quad (4.12)$$

Islamic capital market and money supply

$$KMI_t = a_0 + \sum_{i=1}^{4} a_i KMI_{t-i} + \sum_{j=1}^{4} b_j MS_{t-j} + \varepsilon_t \quad (4.13)$$

$$MS_t = a_0 + \sum_{i=1}^{4} a_i MS_{t-i} + \sum_{j=1}^{4} b_j KMI_{t-j} + \varepsilon_t \quad (4.14)$$

Islamic capital market and Expat remittances

$$KMI_t = a_0 + \sum_{i=1}^{4} a_i KMI_{t-i} + \sum_{j=1}^{4} b_j WR_{t-j} + \varepsilon_t \quad (4.15)$$

$$WR_t = a_0 + \sum_{i=1}^{4} a_i WR_{t-i} + \sum_{j=1}^{4} b_j KMI_{t-j} + \varepsilon_t \tag{4.16}$$

Islamic capital market and exchange rate

$$KMI_t = a_0 + \sum_{i=1}^{4} a_i KMI_{t-i} + \sum_{j=1}^{4} b_j XR_{t-j} + \varepsilon_t \tag{4.17}$$

$$XR_t = a_0 + \sum_{i=1}^{4} a_i XR_{t-i} + \sum_{j=1}^{4} b_j KMI_{t-j} + \varepsilon_t \tag{4.18}$$

The same exercise is repeated for testing causality between conventional capital market and macroeconomic factors by replacing KMI with KSE.

Unit Root Test If we define π_i as the p-value from any individual unit root test for cross-section i, then under the null of unit root for all N cross-sections, we have the asymptotic result that

$$-2 \sum\nolimits_{i=1}^{N} log(\pi_i) \rightarrow x^2_{2N} \tag{5}$$

In addition, Choi suggested Z calculation

$$z = \frac{1}{N} \sum\nolimits_{i=1}^{N} \phi^{-1}(\pi_i) \rightarrow N(0,1) \tag{6}$$

Where ϕ^{-1} is the inverse of the standard normal cumulative distribution function. Asymptotic x^2 and standard normal statistics are calculated by using ADF individual unit root tests. The null hypotheses for group unit root: $H_0 : a_i = 0$ for all i, while the alternative hypotheses: $H_1 : a_i < 0$ for at least one i; (where the i may be reordered as necessary) which may be interpreted as a non-zero fraction of the individual processes is stationary. The Augmented Dickey-Fuller (ADF) Test constructs a parametric correction, over simple DF, for higher-order correlation by assuming that the γ series follows an AR(p) process and adding p lagged difference terms of the dependent variable γ to the right-hand side of the test regression:

$$\Delta\gamma_t = \alpha\gamma_{t-1} + x_t^{'}\delta + B_1\Delta\gamma_{t-1} + B_2\Delta\gamma_{t-2} + ... + B_p\Delta\gamma_{t-p} + \varepsilon_t \tag{7}$$

Where $\alpha = \rho - 1$. The null and alternative hypotheses may be written as: $H_0 : \alpha = 0$, while $H_1 : \alpha < 1$ and evaluated using the conventional t-ratio for α:

$$t_a = a^{\wedge}/(Se(a^{\wedge})) \tag{8}$$

where $a^{\wedge}$ is the estimate of α, and $Se(a^{\wedge})$ is the coefficient standard error.

ADF is based on simple AR(1) process:

$$\gamma_t = \rho\gamma_{t-1} + x_t\delta + \varepsilon_t \tag{9}$$

where x_t are optional exogenous regressors which may consist of constant, or a constant and trend, ρ and δ are parameters to be estimated, and the ε_t are assumed to be white noise. If $|\rho| \geq 1, \gamma$ is a nonstationary series and the variance of, γ increases with time and approaches infinity. If $|\rho| < 1, \gamma$ is a (trend-) stationary series. (Asteriou & Hall, 2007; IHS, 2013).