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CO-INTEGRATION TESTING, USING THE JOHANSEN METHOD, BETWEEN GENERAL INDICATORS OF SOME ARAB FINANCIAL MARKETS IN ASIA

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ABSTRACT

The study aims to examine Co-integration by using the Johansen method between general indicators of some Arab Financial Markets in Asia. The study uses monthly data of the general indicators of stocks in Arab financial markets for the period from 2010-2017. In order to achieve the objectives of the study, the researcher examined the stationary of the indicators. In this regard, all indicators were found stable at the first difference. As a result, the data have met the first condition of co- integration investigation. The study found that the lag period is zero according to (schware) test. Moreover, the analysis of co- integration by testing the Co-integration Rank and the Maximum Eigen value showed the existence of one co- integration at least between Arab Financial Markets in Asia. The study provides a number of recommendations; the most important of which is to support more capital flows between the markets and to use attractive financial instruments for investors in the Arab Financial Markets in Asia. This can be done through the extensive use of Islamic financial instruments. Furthermore, the current paper aims at establishing a monetary integration between the study samples.

Contribution/ Originality: The study aims to examine Co-integration by using the Johansen method between general indicators of some Arab Financial Markets in Asia.

1. INTRODUCTION

Financial markets have largely developed through the flow of capitals among countries due to the important role of financial markets in dealing with investment decisions in countries, especially the Arab countries in Asia, which have relationships in finance and economics. The Co-integration of Arab countries, especially among the Gulf states in general and Jordan, comes to the convergence of geography and traditions, thus enhancing the flow of capital among the countries in question through the financial market, which is considered to be equipped for the investment decision in addition to the dependence of their economies on each other in addition to the movement of the capital, labor, goods exchanging and services. Arab countries seek to reduce transaction costs and legal restrictions to support financial and economic integration. Arab countries depend on each other's economies. Jordan is a major source of investment, especially for the Gulf States; (Saudi Arabia, Bahrain and the United Arab

Emirates). The Gulf States in particular rely on Jordan for the sake of labor, as well as importing agricultural and industrial goods. This is the major reason that the research project comes through the use of the Johansson co-integration method in order to examine whether there is a co-integration between the major indicators of financial markets in Asia (Saudi Arabia, Bahrain, Abu Dhabi, Dubai and Jordan), which have economic, social, political and regional links. The research project covers monthly data for the period from 1/1/2010 to 31/12/2017. These data concern Arab major financial markets in Asia (Saudi Arabia, Bahrain, Abu Dhabi, and Dubai, Jordan). Data are also based on the general indices of monthly stock indicator in the Arab countries. The monthly data on all indicators and accessibility are available in addition to the growing financial and economic relations between the sample countries during this period.

The study will analyze the descriptive statistics of the research sample data. Moreover, it will analyze the relationship between the indicators of the research sample and then it will find out the co-integration through the first step in finding the stationary data. The second step is applying the deceleration period of the data. The third step is finding co- integration based on the slowdown period. Finally, results will be illustrated and later the recommendations of the study will be inferred and stated.

2. THE PROBLEM OF THE STUDY

The problem of the research project comes from the use of the Johannes Co-integration test to examine whether or not there is a Co-integration of the major indicators of the Arab financial markets in Asia (Saudi Arabia Bahrain, Abu Dhabi, Dubai and Jordan) which have economic, social, political and regional linkage. Therefore, the problem of the study can be formulated through the following questions:

- Is there at least one co- integration relationship between the countries of the sample of the study by using the Johansson test?
- Is there more than one Co-integration relationship between the countries that represent the study sample by using the Johansson test?

3. OBJECTIVES OF THE STUDY

The study aims at achieving the following objectives:
- Identify the concept of financial indicators in the countries involved in the current study.
- Identify the development of financial indicators in these countries.
- Analyze the descriptive statistics of the countries of the study sample
- Analyze the correlation between the financial indicators of the countries in question.
- Analyze of Co-integration by using the Johansen test among the financial indicators of the countries involved.
- Obtain results and recommendations to assist investment decision makers of these countries.
- Find out where the investor puts his money to avoid the risks of international investment.

4. THE SIGNIFICANCE OF THE STUDY

The significance of this study is of a high value and benefit to the Arab and foreign investors in financial markets and investors in real investment. In addition, it is highly beneficial to researchers, students and decision makers who invest in the countries concerned. The results of the study are important to support the theoretical and practical aspects of the financial markets.

5. HYPOTHESES OF THE STUDY

The study hypotheses can be formulated depending on the problem as follows –

There is a common integration between the Arab financial markets in the research sample that paves the way for the existence of a unified Arab financial market among all the other Arab countries through the following hypotheses.

- There is at least one significant co-integration relationship with statistical significance (α <0.05) between the countries of the study sample.
- There is more than one co-integration relationship (α <0.05) between the countries involved in the current study.

6. LITERATURE REVIEW

There are several studies on the Co-integration of financial markets but very few of these studies tackled the precise idea of this research with its comprehensive study of the most Arab countries.

HandeErdincn (2009) conducted a study that aims at measuring the Co- integration of the stock markets at some of the main EU countries, France, Germany and the United Kingdom. The study is based on the market indicators of the European countries which (FTSE 100 Indicator, DAX Indicator, CAC4 Indicator, MSCI Indicator) [1]the study used the Johansen test of co- integration where there was a co-integration between the financial markets of the countries concerned due to the similarity of the economic structure in these countries.

Canarella et al. (2008) examine the Co-integration relationship between NAFTA's financial markets, (Canada, México and the United States), through the use of the Johansen test of Co- integration where the study showed an integration relationship between the market of Mexico and the United States of America.

Komlavi (2010) analyzed the Co-integration during the global financial crisis for the period from 2008 to August 2009 by analyzing the co-integration of international financial market indicators for Group of States (OECD Group, Pacific Group, Asia Group). The analysis shows that the three groups have at least one co-integration relationship. This made investors in Asian capital markets never avoid any impact from financial markets, even if some domestic markets are still not fully open to the international market.

Muhammad and Syed (2012;2018) analyzed the determinants of the stock market between Pakistan and Asian economies from 2001 to 2015 by using Philips-Perron (PP) test to verify the co-integration of their financial markets. The results indicate that there is a long-term Co-integration between the Pakistan stock market and Stock markets in China, India, Indonesia, Korea, Malaysia and Thailand.

Neda and Amir (2014) examine the links between equity markets in five Asian countries; Malaysia, Indonesia, Philippines, Japan and Turkey with United States of America. The study used monthly data for the period 1995-2010 through the use of VAR analysis. AR results showed significant market interactions. Moreover, the results showed that the US stocks are interconnected with all Asian stock markets. Furthermore, Japan is strongly intertwined with other Asian markets.

Mohamad and Wael (2013) conducted a study whose aim was to investigate the Co-integration of Arab financial markets mainly through focusing on previously defined countries; Kuwait and Jordan. The study used Johansen test of Co-integration. The study results showed a Co-integration relationship between the Kuwaiti and Jordanian financial markets.

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[1]FTSE 100 Index(is a share index of the 100 companies listed on the London Stock Exchange with the highest market capitalization(https://www.avatrade.sa.com/cfd-trading/indices/ftse-100)

. (DAX) is a stock index that represents 30 of the largest and most liquid German companies that trade on the Frankfurt Exchange.(https://www.avatrade.sa.com/cfd-trading/indices/dax-30)

(CAC 40)The index represents a capitalization-weighted measure of the 40 most significant values among the 100 highest market caps on the Euro next Paris.(https://www.iforex.ae/)

MSCI (Morgan Stanley Capital International)

However, there are many studies and research relevant to financial markets integration of countries that are not economically similar. The study of Walid (2008) examined long-term and dynamic relationships in the short term between the Egyptian Stock Exchange and its counterparts in the Group of Seven (G7). Results showed that the Egyptian stock exchange does not share long-term Co-integration relationships With G7.

Mohanasundaram and Karthikeyan (2015) explore the nature of the relationship among the stock market indices in South Africa, India and the USA. Their study used monthly data from stock indices, JALSH (South Africa), NIFTY (India) and NASDAQ (United States of America). Accordingly, the study led to a strong relationship among the stock market indices in South Africa, India and the United States of America.

Eventually, Mohamad and Wael (2013) examined the extent of Co-integration between EU countries and-Arab financial markets. Test results showed that the null hypothesis of non-integration cannot be accepted if the Arab market Indicator is a dependent variable. However, it can be accepted in the EU is a dependent Variable.

7. THE THEORETICAL FRAMEWORK OF THE STUDY

7.1. Historical Introduction

The financial market of Jordan is one of the oldest markets in the Arab world and was established in 1978. In 1989, the financial market in Bahrain was established and also started an active market in Saudi Arabia. In 2000, the Dubai Stock Exchange and the Abu Dhabi Stock Exchange were established in the United Arab Emirates (Ashraf, 2009).

7.2. Common Features of Arab Financial Markets

The recent Arab financial markets are characterized by some common features, most notably the narrowness of the market. The tightness of the market in the Arab financial markets is due to the limited supply and demand of financial investment instruments in these markets, as well as the concentration of trading in a limited number of shares, The active shares traded to the total volume of trading, reflecting the small number of attractive shares, due to the concentration of some major investors to keep the shares of promising companies, in addition to the low quality of the majority of listed stocks as such the Arab financial markets are characterized by weak diversification of securities, poor liquidity and high volatility. This in turn leads to increased volatility in the profitability of the stock and consequently its market value, which raises fears among investors and presents them with high losses (Ashraf, 2009).

7.3. Benefits of Co- Integration

In this study will analyze the co- integration of financial markets in some Arab countries Where there are many benefits of co- integration between the financial markets of the countries of the region, the most important the management of local markets in an organized , efficient manner, the achievement of Found integration of financial institutions, markets and infrastructure together in the countries of financial integration also reduces the costs of financial intermediaries and increases competition because of the increasing number of financial institutions in the market, increasing financial services and increasing their contribution to growth also further financial development and efficiency, as integration leads to the elimination of financial imbalances and restrictions on the movement of capital In addition, the increase of foreign capital flows to the integration countries the larger and more liquid regional market may be more attractive to investors in international markets. Moreover, regional integration will allow financial institutions to diversify their resources better, reduce geographic and sectorial risks across companies and sectors, and improve the stability of financial systems in the average regional cost of capital and debt while at the same time providing opportunities for further risk reduction through diversification, and improvement in Market liquidity and the availability of new investment instruments (Mark, 2007).

7.4. Indicators of Financial Markets for the Study Sample

The concept of the general market indicator measures the level of indicator in the market, based on a sample of enterprises shares traded in regulated or unregulated capital markets or both. The sample is often selected in such a way as to allow the indicator to reflect the situation in which the capital market is intended to be measured (http://www.arabapi.org) .

In addition, the indicators are the value that measures the actual changes in the indicator of securities traded in the financial markets, using a mathematical equation that matches the nature of each financial market so as to identify the movement of indicator, trends and market performance. The main objective is to identify the movement of stock indicator in the financial market indicators of financial markets, during the years of study (Dredid, 2012).

The general indicators of stock indicator in the financial markets were based on the market trend and the study of the co- integration of financial markets; because they indicate the levels of stock indicator and determine indicator general price Stock price during a certain period, compared with another period (Shukairy and Saleh, 2012).

7.4.1. The Saudi Financial Market Indicator. (*TASI*)

(TASI) is a digital standard which reflects changes in the market value of shares of all companies traded on Saudi stock market, and then it serves as a thermometer that measures the activity and prosperity of stock market (Ibrahim, 2005).

Figure (1) represents the Saudi Financial Market Indicator. (TASI), which reflects the trend of Saudi's Financial Market Indicator during the study period for the monthly data during 2010-2017. It can be noted from the form that the trend of indicator in the market is raising at the beginning of the study until the summit reached in mid-2014.then the market trend began to decline and continued until it reached the bottom in the first third of 2016, as a result the market went in a bullish direction.
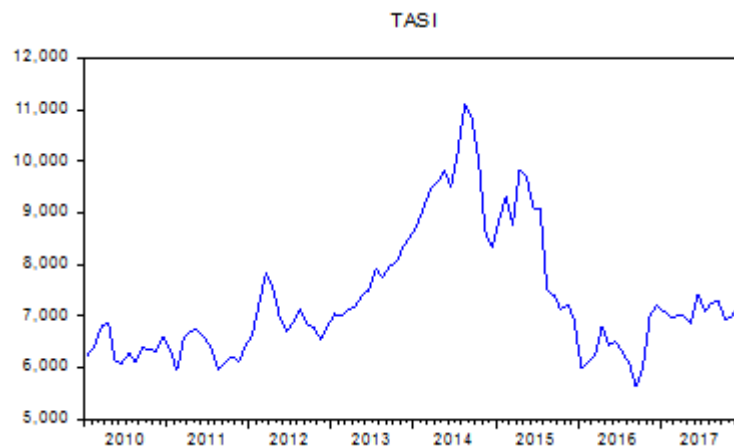
Figure-1. Saudi Financial Market Indicator.
Source: E-views program dependent on appendix (5)

7.4.2. Dubai Financial Market Indicator (DFMGI)

Figure (2) Dubai Financial Market indicator (DFMGI) reflects the trend of Dubai's Financial Market Indicator during the study period for the monthly data during 2010-2017. According to the form, it is notable that the trend of the indicator in the market is raising at the beginning of the study until it reaches the summit in mid of-2014, then the indicator began to decline and continued until it reaches the bottom in mid of-2015, followed by a gradual rise in indicator.
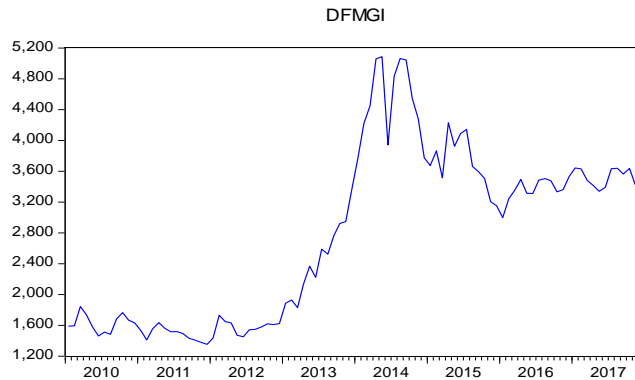
DFMGI

Figure-2. Dubai Financial Market Indicator (DFMGI)
Source: E- views program based on appendix (5)

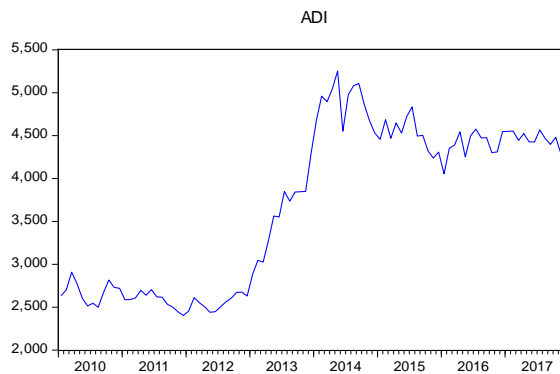### 7.4.3. Abu Dhabi Financial Market Indicator (ADI)

Figure (3) represents Abu Dhabi's Financial Market indicator (ADI). Which reflects the trend Abu Dhabi's Financial Market Indicator during the study period for the monthly data for the period 2010-2017. It is noted from that the indicator trend in the market is raising at the beginning of the study until it reaches the summit in mid-2014, then the indicator begins to decline and continues until it reaches the bottom in mid-2015 then the market started to rise.

ADI

Figure-3. Abu Dhabi's Indicator (ADI).
Source: E- views program based on appendix (5).

According to the form above, it is notable that the markets are moving according to Dow's technical analysis in the Saudi's financial market, Dubai's and Abu Dhabi's Financial Market; indicating that the market is fluctuating then became stable based on Dow's theory in financial market (Dredid, 2012).

7.4.4. Bahrain's Financial Market Indicator (BAX)

Figure (4) represents the general indicator of Bahrain's Financial Market, which reflects the trend of the general Indicator of Bahrain Financial Market during the study period for the monthly data from 2010-2017. Based on the Figure, the indicator's trend in the market begins to decline at the beginning of the study until it reaches the bottom at the end of 2012. Then the indicator inclines and continued until it reaches the summit at the third quarter of 2014, then the market declines until it reaches the bottom at the second quarter of 2016. In conclusion, the market started to rise one again.

Bahrain's market is different from the other markets (Saudi Arabia, Dubai and Abu Dhabi) since the previous markets were having rising trends at the beginning of the study then they started to decline at the end of the study, while Bahrain market was at an opposite direction; it kept fluctuating between bearish trend and bullish trend at until the end of the study due to the fact that the financial markets are affected by economic events and investor movements among other financial markets.
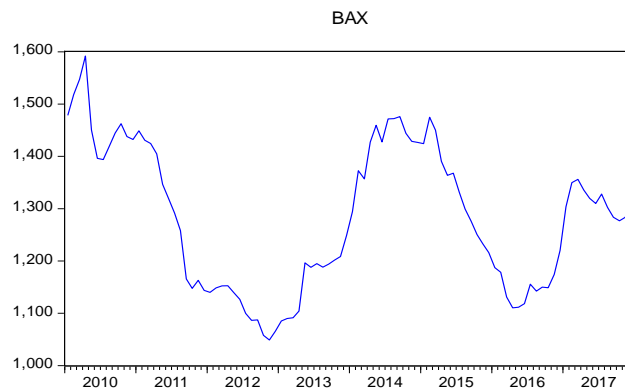
BAX

Figure-4. Bahrain Indicator (BAX)
Source: E- views program based on appendix (5)

7.4.5. Amman's Financial Market Indicator (AMGNRLX)

Figure (5) represents Amman's Financial Market Indicator (AMGNRLX), which reflects the trend Amman Financial Market Indicator during the study period. As the form shows price trend fluctuation in the market and began to decline at the beginning of the study until it reached the bottom in the third quarter of 2013. The indicator trend started to incline until it reaches the summit in the first quarter of 2014. The market kept fluctuating until the end of the study because financial markets are affected by political and economic events as well as by crises in neighboring countries and the whole region in general.

Jordanian market is different from the Saudi's market, Dubai's market and Abu Dhabi's market. The previous markets were bullish at the beginning of the study, and then the markets declined at the end of the study, while Bahraini market was having the same position of the Jordanian market during the period of the study; whereas the markets were downward, then took the upward trend. The trend went downward at the end of the study because of the financial market is affected by political and economic events.
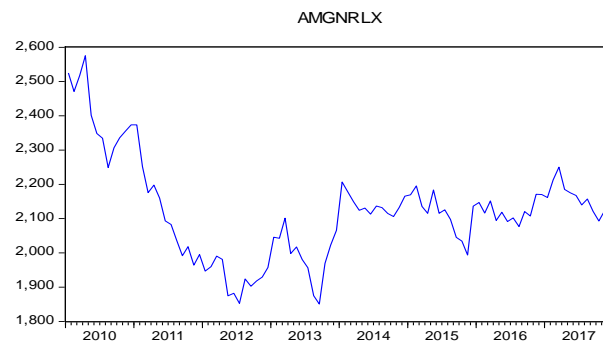
AMGNRLX

Figure-5. Amman's Financial Market Indicator (AMGNRLX)
Source: E- views program based on appendix (5)

8. DESCRIPTIVE STATISTICS

It's notable from Appendix (1) that the highest values for the indicators were for the Saudi's Indicator with (11112.12) points, while the lowest values for indicators were for Bahrain with (1048) points. According to the average price, as can be noticed from Appendix (4) that the highest average price for the Saudi's Indicator was (7357.543) points while the lowest values was for the Bahrain's Indicator of (1282.894) points. In addition, the standard deviation (risk) Saudi Indicator had the highest value but least for Abu Dhabi Indicator as for Skewness, all indicators have torsion on the right except Abu Dhabi's Indicator that has negative torsion and fluctuations to the left, meaning that the indicators do not follow the normal distribution, confirmed by the (Jargue − Bera) test at level (a <0.05).

9. THE CORRELATION BETWEEN THE INDICATORS OF ARAB FINANCIAL MARKETS IN COUNTRIES OF THE STUDY SAMPLE

Table (1), shows a strong correlation between (ADI); the Indicator and the (DFMGI) Indicator Correlation has reached 98%, while the correlation (61%) was between the (TASI) and (AD I). In addition, the (71%) correlation was between (AMGN) and (BAX). Furthermore the value of correlation was (71%) between (TASI) and (DFMGI), but the remaining indicators have lower relations among them. As for (TASI) and (AMGN), it was negative due to the rise in the general Indicator of the Saudi's stock indicator, reflecting the activity in the Saudi market and pointing to a decrease in the Jordanian market activity. Consequently, the decline in the indicator of Jordanian market is due to the Saudi's investors and their movements in between the two markets.

Table-1. Expresses correlation between indicators in countries of study sample.

TASI	DFMGI	BAX	AMGNRLX	ADI	
0.614469	0.980237	0.198382		1.000000	ADI
-0.104225	0.018808	0.766862	0.014515	0.014515	AMGNRLX
0.365869	0.268290	1.000000	1.000000	0.198382	BAX
0.715017	1.000000	0.268290	0.766862	0.980237	DFMGI
1.000000	0.715017	0.365869	0.018808	0.614469	TASI

Source: E- views program based on appendix (5)

10. ANALYSIS OF JOHANSEN CO-INTEGRATION

In order to find the Co-integration through the first step is to find out the stationary data, the second step is to apply a deceleration period of data whereas the third step is finding a Co integration as follows,

First: The Stationary Test

In order to calculate co- integration, all variables must be stable at the same level.

The rooted unit will be tested using the dickey fuller method in which the unit root is being applied. On other hand, all indicators of the study are found unstable, but they settle at the first difference. Appendix (2), shows that all variables are stabilized at the first difference. It's necessary to achieve using Johansen co- integration.

The results of unit root test to be contained in the appendix (I). The Indicators; TASI, DFMGI, ADI , BAX , AMGNRLX are not stationary at any level ,but stationary at 1 %, 5%, and 10% level, with the first difference (d(1)); indicated by ADF results at all levels less than the critical values in negative direction. The ADF value for (TASI) is (-8.372111) and the critical values are **(-2.589795) (**-1.944286**) and** (-1.614487**)** at 1, 5, and 10 percent, respectively. The ADF value for (DFMGI) is (-10.33292**)** and the critical values are (-2.589795) (-1.944286**) and (**-1.614487**)** at 1, 5, and 10 %, respectively. The ADF value for (ADI) is **-**11.00283**)** and the critical values are (-2.589795) (-1.944286**) and (-1.614487**)** at 1, 5, and 10 %, respectively. The ADF value for (BAX) is (-6.918654**) and** the critical values are (-2.589795) (1.944286) and (-1.614487**)** at 1, 5, and 10 %, respectively. The ADF value for (AMGNRLX) is (**-10.05620)** and the critical values are (**-2.589795) (– 1.944286)** and (**-1.614487)** at 1, 5, and 10 %, respectively.

Second: The Deceleration Test

It can be noticed from Appendix (3) the deceleration test (E-Views) values by using (summarize all 5 sets of assumption(. Additionally, it can be noted that the deceleration period shows the lowest value selected in (linear intercept no trend model) because it is a better Model of Johansen co- integration. In addition, Appendix (2) shows that the deceleration period (zero) gives the lowest value when testing (Schwarz) because it gives the best results among tests.

Third: Johansen Co- Integration Test

It can be noticed from Appendix (4) which shows that there is one Co-integration between the general indicators of stock indicator in financial markets of the country in Asia (the study sample). As shown in Appendix (4) unrestricted Co-integration Rank Test) (Trace). Furthermore, it also can be noticed from Appendix (4) that confirms the results of) Unrestricted Co-integration Rank Test (Maximum Eigen value) which means there is a single Co-integration between the general indicators of stock indicator in the financial markets of the country in Asia (The study sample). Consequently, it's been accepted that there is one Co-integration between general indicators of stock indicator in financial markets of the countries in Asia (The study sample), but rejects the hypothesis that there is more than co- integration between general indicators of stock indicator in financial markets of the country in Asia (The study sample).

11. THE RESULTS

By reviewing the previous studies where there were many studies on the integration of some of the financial markets However, the results of this study were different in addition to the difference in the study sample as follows

The main financial markets in the Arab countries in Asia have positive correlation between some of them. There   is a positive relationship between Saudi Arabia and Dubai. There is also a positive correlation between Saudi Arabia and Abu Dhabi. Also, there is a positive relationship between Dubai and Abu Dhabi, and a positive relationship between Jordan and Bahrain. The analysis of Johansen Co-integration test showed that there is at least one Co-integration between financial markets (the sample of the study) by testing Trace Unrestricted Co-integration Rank Test (and Co-integration Rank Test (Maximum Eigen value.

12. RECOMMENDATIONS

The following study has come up with the following recommendations:

- The Co-integration of financial markets of Arab countries should be supported by the flow of more funds between them to increase their co- integration.
- Support Co-integration among Arab countries towards enhancing economic and financial integration
- Achieve monetary integration among countries of the study sample to gradually spread to all Arab countries.
- Dealing with attractive financial instruments for Arab investors through the use of Islamic financial instruments to support joint integration between Arab countries.
- Making more studies about co- integration of other Arab financial markets and other foreign countries.

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APPENDICES

Appendix (1)

TASI	DFMGI	BAX	AMGNRLX	ADI	
7357.543	2780.149	1282.894	2120.804	3703.766	Mean
7000.905	3074.385	1287.685	2119.450	4145.380	Median
11112.12	5087.470	1591.940	2575.470	5253.410	Maximum
5623.340	1353.390	1048.810	1850.590	2402.280	Minimum
1228.129	1119.480	137.3364	146.6717	944.7470	Std. Dev.
1.150843	0.214465	0.103572	0.731302	-0.144011	Skewness
3.544155	1.792564	1.811977	3.920888	1.326896	Kurtosis
22.37544	6.567531	5.817233	11.94899	11.52893	Jarque-Bera
	0.037487	0.054551	0.002543	0.003137	Probability
706324.1	266894.3	123157.8	203597.2	355561.6	Sum
1.43E+08	1.19E+08	1791823.	2043697.	84791949	Sum Sq. Dev.
96	96	96	96	96	Observations

Appendix (2)

Null Hypothesis: TASI has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=1)

Prob.*	t-Statistic			
0.6588	-0.064250	Augmented Dickey-Fuller test statistic		
	-2.589531		1% level	Test critical values:
	-1.944248		5% level	
	-1.614510		10% level	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(TASI) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=1)

Prob.*	t-Statistic			
0.0000	-8.372111	Augmented Dickey-Fuller test statistic		
	-2.589795		1% level	Test critical values:
	-1.944286		5% level	
	-1.614487		10% level	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: DFMGI has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=1)

Prob.*	t-Statistic			
0.7380	0.185705	Augmented Dickey-Fuller test statistic		
	-2.589531		1% level	Test critical values:
	-1.944248		5% level	
	-1.614510		10% level	
	*MacKinnon (1996) one-sided p-values.			

Null Hypothesis: D(DFMGI) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=1)

Prob.*	t-Statistic			
0.0000	-10.33292	Augmented Dickey-Fuller test statistic		
	-2.589795		1% level	Test critical values:
	-1.944286		5% level	
	-1.614487		10% level	
	*MacKinnon (1996) one-sided p-values.			

Null Hypothesis: ADI has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=1)

Prob.*	t-Statistic			
0.8738	0.746064	Augmented Dickey-Fuller test statistic		
	-2.589531		1% level	Test critical values:
	-1.944248		5% level	
	-1.614510		10% level	
	*MacKinnon (1996) one-sided p-values.			

Null Hypothesis: D(ADI) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=1)

Prob.*	t-Statistic			
0.0000	-11.00283	Augmented Dickey-Fuller test statistic		
	-2.589795		1% level	Test critical values:
	-1.944286		5% level	
	-1.614487		10% level	
	*MacKinnon (1996) one-sided p-values.			

Null Hypothesis: BAX has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=1)

Prob.*	t-Statistic			
0.4467	-0.619042	Augmented Dickey-Fuller test statistic		
	-2.589795		1% level	Test critical values:
	-1.944286		5% level	
	-1.614487		10% level	
	*MacKinnon (1996) one-sided p-values.			

Null Hypothesis: D(BAX) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=1)

Prob.*	t-Statistic			
0.0000	-6.918654	Augmented Dickey-Fuller test statistic		
	-2.589795		1% level	Test critical values:
	-1.944286		5% level	
	-1.614487		10% level	
	*MacKinnon (1996) one-sided p-values.			

Null Hypothesis: AMGNRLX has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=1)

Prob.*	t-Statistic			
0.2895	-0.983227	Augmented Dickey-Fuller test statistic		
	-2.589531		1% level	Test critical values:
	-1.944248		5% level	
	-1.614510		10% level	
	*MacKinnon (1996) one-sided p-values.			

Null Hypothesis: D(AMGNRLX) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=1)

Prob.*	t-Statistic			
0.0000	-10.05620	Augmented Dickey-Fuller test statistic		
	-2.589795		1% level	Test critical values:
	-1.944286		5% level	
	-1.614487		10% level	
	*MacKinnon (1996) one-sided p-values.			

Appendix (3)

Date: 09/01/18   Time: 18:23
Sample: 2010M01 2017M12
Included observations: 93
Series: ADI AMGNRLX BAX DFMGI TASI
Lags interval: 1 to 2

Selected (0.05 level*) Number of Cointegrating Relations by Model

Quadratic	Linear	Linear	None	None	Data Trend:
Intercept	Intercept	Intercept	Intercept	No Intercept	Test Type
Trend	Trend	No Trend	No Trend	No Trend	
0	0	1	1	0	Trace
0	0	1	1	0	Max-Eig

*Critical values based on MacKinnon *et al.* (1999)

				Schwarz Criteria by Rank (rows) and Model (columns)	
62.69288	62.51119	62.51119	62.30937*	62.30937*	0
62.80112	62.66780	62.62281	62.46057	62.56349	1
63.07975	62.97848	62.88655	62.76390	62.88529	2
63.43249	63.35725	63.23582	63.16190	63.27838	3
63.83084	63.80374	63.66671	63.61892	63.71964	4
64.28414	64.28414	64.10893	64.10893	64.20660	5

Appendix (4)

Date: 08/28/18   Time: 22:11
Sample (adjusted): 2010M02 2017M12
Included observations: 95 after adjustments
Trend assumption: Linear deterministic trend
Series: ADI AMGNRLX BAX DFMGI TASI
Lags interval (in first differences): B0 to
Unrestricted Cointegration Rank Test (Trace)

	0.05	Trace		Hypothesized
Prob.**	Critical Value	Statistic	Eigenvalue	No. of CE(s)
0.0245	69.81889	73.54019	0.308005	None *
0.2780	47.85613	38.56349	0.197686	At most 1
0.5928	29.79707	17.63927	0.101271	At most 2
0.5208	15.49471	7.495814	0.051763	At most 3
0.1178	3.841466	2.446521	0.025424	At most 4
Trace test indicates 1 co-integratingeqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon *et al.* (1999) p-values				
Unrestricted Co-integration Rank Test (Maximum Eigenvalue)				
	0.05	Max-Eigen		Hypothesized
Prob.**	Critical Value	Statistic	Eigenvalue	No. of CE(s)
0.0368	33.87687	34.97670	0.308005	None *
0.2808	27.58434	20.92422	0.197686	At most 1
0.7311	21.13162	10.14345	0.101271	At most 2
0.7356	14.26460	5.049293	0.051763	At most 3
0.1178	3.841466	2.446521	0.025424	At most 4

Max-eigenvalue test indicates 1 co-integratingeqn(s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
**MacKinnon *et al.* (1999) p-values

Appendix (5)

TASI	DFMGI	BAX	AMGNRLX	ADI	obs
6252.55	1589.97	1478.23	2525.1	2633.37	2010M01
6437.5	1592.91	1518.06	2470.88	2703.56	2010M02
6801.01	1843.47	1547.13	2517.72	2908.49	2010M03
6867.97	1739.88	1591.94	2575.47	2777.12	2010M04
6120.52	1579.54	1450.28	2401.57	2604.17	2010M05
6093.76	1461.8	1396.29	2348.56	2514.01	2010M06
6283.73	1512.4	1393.92	2334.77	2545.8	2010M07
6106.42	1483.67	1418.61	2249	2498.52	2010M08
6392.39	1683.69	1444.76	2306.46	2673.19	2010M09
6353.88	1764.54	1462.42	2335.61	2816.11	2010M10
6318.5	1668.82	1437.94	2354.6	2729.87	2010M11
6620.75	1630.52	1432.26	2373.58	2719.87	2010M12
6358.03	1534.4	1448.85	2373.78	2586.75	2011M01
5941.63	1410.7	1430.77	2251.73	2588.9	2011M02
6562.85	1556.04	1424.64	2175.59	2607.12	2011M03
6710.56	1634.13	1404.9	2198.01	2695.5	2011M04
6735.98	1559.92	1346.66	2159.83	2639.14	2011M05
6576	1516.93	1319.71	2093.52	2704.19	2011M06
6392.13	1517.58	1291.66	2082.8	2619.7	2011M07
5979.3	1492.44	1258.25	2036.43	2616.02	2011M08
6112.37	1431.71	1165.75	1991.6	2533.41	2011M09
6224.3	1408.06	1147.66	2018.15	2501.43	2011M10
6104.56	1378.94	1163.11	1964.22	2444.86	2011M11
6417.73	1353.39	1143.69	1995.13	2402.28	2011M12
6626.04	1435.72	1139.83	1946.61	2453.98	2012M01
7271.82	1730.43	1148.64	1959.75	2611.13	2012M02
7835.15	1648.87	1152.45	1990.4	2553	2012M03
7558.47	1630.95	1152.79	1981.2	2503.82	2012M04

6975.27	1471.49	1139.58	1874.5	2441.03	2012M05
6709.91	1451.87	1126.71	1882.07	2447.62	2012M06
6878.19	1542.64	1099.82	1852.48	2506.23	2012M07
7139.01	1547.82	1086.32	1923.95	2561.61	2012M08
6839.83	1578.79	1087.33	1902.68	2605.41	2012M09
6791.04	1619.61	1057.91	1917.87	2672.43	2012M10
6533.14	1607.9	1048.81	1929.28	2674.56	2012M11
6801.22	1622.53	1065.61	1957.6	2630.86	2012M12
7043.55	1887.59	1085.14	2045.73	2881.78	2013M01
6998.33	1927.1	1089.94	2042.42	3044.89	2013M02
7125.73	1829.24	1091.58	2101.36	3025.33	2013M03
7179.8	2135.4	1104.17	1998.13	3273.63	2013M04
7404.12	2366.79	1196.46	2017.47	3562.88	2013M05
7496.57	2222.57	1187.79	1980.53	3551.24	2013M06
7915.11	2588.53	1194.9	1956.52	3847.43	2013M07
7766.52	2523.13	1188.27	1874.96	3734.55	2013M08
7964.91	2762.5	1193.93	1850.59	3842.98	2013M09
8044.47	2922.18	1201.79	1969.34	3845.72	2013M10
8325.280000000001	2945.91	1208.55	2022.63	3849.84	2013M11
8535.6	3369.81	1248.86	2065.83	4290.3	2013M12
8760.620000000001	3770.38	1294.33	2206.96	4673.07	2014M01
9106.549999999999	4220.45	1372.67	2178.17	4958.66	2014M02
9473.709999999999	4451	1356.91	2148.93	4894.42	2014M03
9585.219999999999	5058.95	1427.33	2124.15	5044.62	2014M04
9823.4	5087.47	1459.34	2130.92	5253.41	2014M05
9513.02	3942.82	1427.61	2113.03	4551.020000000001	2014M06
10214.73	4833.24	1471.7	2136.57	4976.16	2014M07
11112.12	5062.96	1472.16	2131.91	5082.72	2014M08
10854.79	5042.92	1476.02	2114.98	5106.29	2014M09
10034.92	4545.390000000001	1444.13	2106.13	4861.45	2014M10
8624.89	4281.43	1428.66	2132.49	4671.29	2014M11
8333.299999999999	3774	1426.57	2165.46	4528.93	2014M12
8878.540000000001	3674.4	1424.37	2169.61	4456.82	2015M01
9313.52	3864.67	1474.81	2195.46	4686.189999999999	2015M02
8778.89	3514.4	1449.97	2135.43	4467.93	2015M03
9834.49	4229.04	1390.62	2115.53	4647.12	2015M04
9688.69	3923.24	1363.67	2183.57	4527.63	2015M05
9086.89	4086.83	1367.83	2115.64	4723.229999999999	2015M06
9098.27	4143.21	1331.66	2125.72	4834.22	2015M07
7522.47	3662.56	1299.24	2097.59	4493.93	2015M08
7404.14	3593.28	1275.89	2045.23	4502.79	2015M09
7124.8	3503.75	1250.37	2034.42	4322.04	2015M10
7239.93	3204.28	1232.57	1993.72	4236.390000000001	2015M11
6911.76	3151	1215.89	2136.32	4307.26	2015M12
5996.57	2997.77	1187.1	2147	4054.37	2016M01
6092.5	3239.7	1178.23	2116.25	4351.41	2016M02
6223.13	3355.53	1131.11	2151.89	4390.42	2016M03
6805.84	3491.91	1110.53	2094.72	4543.53	2016M04
6448.42	3313.72	1111.56	2118.44	4250.2	2016M05
6499.88	3311.1	1118.37	2091.35	4497.640000000001	2016M06
6302.17	3484.32	1155.62	2102.13	4575.34	2016M07
6079.51	3504.4	1142.21	2076.83	4471.01	2016M08
5623.34	3474.38	1150	2120.46	4476.32	2016M09
6012.22	3332.41	1148.83	2107.58	4300.18	2016M10
7000.18	3360.91	1174.12	2170.98	4308.770000000001	2016M11
7210.43	3530.88	1220.45	2170.29	4546.37	2016M12
7101.86	3642.85	1303.7	2161.47	4548.82	2017M01
6972.39	3630.34	1349.67	2212.76	4552.09	2017M02
7001.63	3480.43	1355.99	2250.18	4443.53	2017M03

7013.47	3414.93	1335.67	2185.26	4522.56000000001	2017M04
6871.24	3339.37	1319.75	2175.18	4427.3	2017M05
7425.72	3392	1310.04	2167.4	4425.399999999999	2017M06
7094.17	3633.18	1327.81	2139.82	4566.149999999999	2017M07
7258.64	3637.55	1302.46	2157.26	4468.41	2017M08
7283.01	3563.99	1283.46	2121.52	4397.399999999999	2017M09
6934.37	3635.87	1276.69	2093.19	4479.600000000001	2017M10
7003.97	3420.17	1283.71	2122.47	4283.07	2017M11
7226.32	3370.07	1331.71	2126.78	4398.439999999999	2017M12