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STUDYING THE INTEGRATION OF DAMASCUS SECURITIES EXCHANGE WITH SELECTED STOCK MARKETS

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ABSTRACT

This study aims to examine the integration of Damascus Securities Exchange (DSE) with some Arab and international financial markets, which are (Jordan, Iraq, Germany, and France). The study used monthly data of each stock market index during the period 2010-2015. To achieve the objectives of the study, five tests are used. Namely, Unit Root Test, Johansen Cointegration Test, Vector Error Model, Vector Autoregressive Models (Impulse Response Function and Variance Decomposition) and finally Granger Causality. The findings show a long-run relationship between DSE and other studied markets. Consequently, markets move together in a long-term. No evidence is found about short-term relationship. In addition, DSE seems to respond slowly to changes in the other markets; as a result, shocks on these markets do not explain the variation on DSE index. Finally, Granger Causality test reveals absence of causality among these markets. Thus, investors can benefit from diversifying their portfolios in short-term, but not in the long-term.

Keywords: Stock markets integration, Globalization, Law of one price, Capital asset pricing model (CAPM), Cointegration, VECM model, Damascus securities exchange (DSE).

Contribution/ Originality:

This paper is the first research examines the integration of Damascus Securities Exchange with the Arab and international markets during the period 2010-2015. In addition, it is considering the impact of the Syrian crisis on the relationship between Damascus market and other markets

1. INTRODUCTION

Globalization has become a symbol of the present days and the main topic of social sciences. The global economy has many developments such as capital account liberalization, financial deregulation, low cost of communications, technological developments, and the increase in the speed of financial innovation, this has made the global economy moves towards one market (Lane and Milesi-Ferretti, 2008; Claudiu, 2012). Furthermore, reducing barriers that prevent the free flow of goods, services and capital, the increased number of countries that have abolished controls on the exchange rate, the creation of trade blocs such as NAFTA and European Union (ElSerafie and Abdel, 2002) have led to the integration of global financial markets and prompted investigation about the law of one price across the world.

The interest in studying the correlation between developed and emerging financial markets has increased greatly over previous years (Guha *et al.*, 2004). Mainly because investors want to diversify their investment

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portfolios to make abnormal return and avoid risks. Furthermore, policy makers are concerned about the risks of shocks transmission among integrated market, especially during crises. In general, the degree of linkage; co-movement or interdependence among the stock markets provide important implications on potential benefits of international portfolio diversification and on financial stability of country (Modi *et al.*, 2010).

The term of financial market integration refers to the area of research in macroeconomics which covers many aspects of mutual relations among financial markets (Marashdeh, 2006). The financial market is integrated with other markets when the investors in this market can buy and sell securities that have been issued in other markets (other countries) without legal restrictions; transaction costs; and customs fees on trade in foreign assets (ElSerafie and Abdel, 2002). Thus, securities are issued and traded at the same price in these markets after adjusting for foreign exchange rates. However, Pukthuanthong (2009) defines the term Co-Movement as the tendency of two or more stock markets to move together at the same time, so the prices movement are linked positively together. In other words, the integration of stock markets involves similar prices for each asset return and risk.

Forbes and Rigobon (2002) indicate that contagion also means the linkage and integration of financial markets. They claim that when stock market exposed a shock, this shock will move to other markets quickly through the linkages between these markets. More precisely, the term contagion refers to increase co-movement among stock markets during crises. Therefore, the concept of financial markets integration emphasizes not only the openness of these markets, but also how far is the transfer of shocks across these markets (Atyeh and AL-Rashed, 2013).

The concept of financial market integration is based on diverse theoretical literature; the most important aspect is the Law of One Price (LOOP), which is developed by Marshall (1930). This law states that similar prices for similar goods. This law is of great importance to international trade models in terms of determining the exchange rate and examining the extent of financial markets integration and Capital Asset Pricing Model (CAPM) (Yang *et al.*, 2000). When there is one price for several spatially separate markets, this means markets are integrated as one market.

When LOOP is realized, it reflects the absence of arbitrage opportunities. Thus, the financial markets is seeking to integrate with each other. Hence, when the price of financial asset changes in two markets, it will lead to different returns in both markets with each return being consistent with the price of that asset. The LOOP is used by many researchers to measure the degree of market integration. Markets are integrated when the assets are priced evenly across border. Therefore, if there is absence of restrictions on trading or possibility of arbitrage, the price will be equal after adjusting transaction costs and exchange rates (Horen et al., 2008).

The second law is the Capital Asset Pricing Model (CAPM). It was the result of the works done by Sharpe (1964); Mossin (1966); Linter (1965) and Treynor. This model is an economic model to evaluate the stock through linking the risks to the expected returns. The most important assumptions underlying this model are Fama and French (2004):

- The market is segmented.
- Investors are rational; dislike risks and they are interested in maximizing their wealth.
- Investors can't influence on the stock price by their trading.
- All investors are planning for identical periods.
- Investors have formed their portfolios of the world around them by trading of financial assets; they get also loans without risks and unlimited ratios.
- The market is perfect; there is no tax on profits and no costs on transaction trading of securities.

Thus, according to the assumptions of CAPM, the identical securities will have the same expected returns and same risks. Consequently, are priced the same in the markets, after imposing transaction costs and tax profits. Black

(1972) was then developed CAPM because of some unrealistic assumptions underlying, such as lending risk-free (Fama and French, 2004). In addition, CAPM has become method to measure and examine the financial markets integration, where it is assumed that financial markets are integrated when two securities with same risk characteristics in two different markets have the same price levels (Atyeh and AL-Rashed, 2013).

In Syria, Damascus Securities Exchange (DSE) was established by Legislative Decree NO.55 of 2006. DSE includes two main markets, the regular and parallel markets. As an emerging market, and taking into account the crisis in Syria which started in March 2011, it is thought that such research would be of great importance to investigate the integration of DSE with other markets. Particularly, the nature of the relationship between DSE and other markets and its impact on markets stability and investors.

This paper is divided into five sections: the second section is literature review, followed by data and research methods. Research results then presented in section four, and finally, research conclusions are presented in section five.

2. LITERATURE REVIEW

Financial market integration has become one of the most debated issues in the economic world. This trend began with the collapse of Britton Woods system in1970's (Altin and Sahin, 2010). Many researchers studied integration among stock markets; however, no specific measure is developed to determine which stock market integrated with the others. It always depends on the period and the markets being studied.

Tabak and Lima (2002) studied causality and cointegration of stock markets in Latin America (Colombia, Mexico, Peru, Venezuela, Chile, Brazil and Argentina) and the United States. They used daily data for indices from January 1995 until March 2001, by applying cointegration approach and impulse response function; they found that there is no signs of cointegration between Latin American markets and USA market. Thus, there is a benefit for investors to diversify their portfolios in these markets. Granger Causality test revealed a relation between Brazil and other Latin American markets, also Mexico market is influenced by USA market more than other markets.

Aggarwal and Kyaw (2005) examined the integration of three major financial markets (Canada, Mexico and the United States) before and after NAFTA in 1993. They used daily; weekly and monthly data and applied Johansen approach cointegration. The results showed a strong correlation between markets after NAFTA. In fact, this integration reflected the commercial activities and bilateral contracts among three countries. This might have led to fewer benefits for investors to diversify their portfolios in these three markets after 1993.

Marashdeh (2006) studied the integration between four emerging markets in the Middle East (Egypt, Jordan, Morocco and Turkey) and North Africa with three developed markets (United States, United Kingdom, and Germany). The researcher used monthly data for returns in both local currency and US dollar. The methodology included Autoregressive Distributed Lag (ARDL) to examine the cointegration, and Granger Causality for short term. The results showed presence of a long run relationship between MENA markets, but no relationship with developed market was found. Thus at the regional level, investors cannot get abnormal returns in the long term, but at the international level there is a benefit for investors to diversify their portfolios within developed markets namely (USA, UK, Germany).

Modi *et al.* (2010) studied comovement between emerging markets (India, Hong Kong, Mexico, Russia, Brazil) and developed markets (USA, UK) by analyzing correlation between indices and returns, in the short and long term from July 1997 till June 2008. They found a high degree of correlation between India stock index and both indices (Nasdaq and DJ), and low correlation with Mexico and Brazil indices. Accordingly, there is no opportunity to diversify between India market and both Mexico and Brazil Markets. On the other hand, the least correlated indices were Brazil index and both Nasdaq & Dow Jones, Hong Kong index. That means these stock markets are attractive to investors who want to diversify their investment portfolios.

By using cointegration framework which developed by Engle and Granger (1987); Heilmann (2010) examined the links between seven indices from Asian stock markets (Japan, Hong Kong, South Korea, Thailand, Singapore, Malaysia, Philippine) and Standard & Poor's index. Weekly data index in local currency is used during the period January 1995 until August 2010. The results showed a long run relationship between Asian markets and S&P, in addition Error Correction Model pointed that US market has a strong impact on Asian markets in both short and long term, especially South Korea market. The results also showed that South Korea and Taiwan markets are the fastest in respond to changes in US market while Malaysia and Philippine were barely respond.

Altin and Sahin (2010) verified integration of securities markets at the regional level. They used daily data of 31 stock indices in the period 2005-2010. They studied the relationship in short and long term among these markets (Europe-Asia/Pacific-Brics and Turkey). The researchers used two tests to examine integtation, namely Johansen Jusiluis and Engle & Granger. In addition, impulse response function and variance decomposition from VAR model are used. The results revealed the existence of long run relationship among the markets because of financial liberalization at regional level, as well as the importance of UK, Japan, and USA in their regions.

Moldovan and Medrega (2011) aimed to study mutual relationship among international stock markets, to check whether the interdependence is stronger during crisis periods. Researchers choose three global indices, Dow Jones, FTSE100 and NIKKEI. Daily data from January 2004 until May 2011 is analysed by multiple regression to test relationships between each two indices before and after crisis. They found that the period that preceded crisis showed a correlation between DJ and FTSE100 indices, while NIKKEI was less affected by DJ index with negative association. It was explained by investors' movement from USA to Tokyo stock exchange. The results also found a very high correlation among three indices during crisis.

Gupta and Guidi (2012) studied links between India and three Asian markets (Hong Kong, Japan and Singapore). Johansen cointegration approach was used to verify the correlation among markets in a long term, in addition to Time-Varying and DCC-GARCH models. The results showed a short-run relationship between India and other markets, but no long-run relationship. This offers benefits to Indian investors who wish to invest in emerging markets by diversifying their investment portfolios on a long-term.

Atyeh and AL-Rashed (2013) examined the integration between two Arab financial markets (Jordan and Kuwait) from June 2001 until March 2010 by using Johansen cointegration. The results indicated the existence of long-run relationship between both markets. Thus, these two markets move together at the same direction in the long-term. As a result, investors cannot benefit from diversifying their portfolios in these two markets, however in the short-term abnormal profits may be realized.

Yang *et al.* (2014) studied cointegration among 26 global stock markets during subprime crises and debt crises. The results showed that crisis have changed cointegration relations among stock markets' indices. United States; Japan and China are characterized by their impact on all markets indices over different periods. In addition, before the subprime crises there was no evidence of comovement between China market and other markets. However, after subprime crisis and European debt China market became more integrated with all stock markets. The findings revealed that before subprime crisis, the developed stock markets led global stock markets. However, after both crises, the emerging markets have become the driving force in the global stock markets.

A study by Guidi and Ugur (2014) examined the integration of Southern-Eastern Europe markets (Bulgaria, Croatia, Romania, Slovenia and Turkey) with developed markets (Germany, USA and UK) by using cointegraion approach during 2000-2013. Weekly data of stock indices and returns are used, they found that Southern-Eastern

Europe markets integrated with Germany and UK during 2008-2013, consequently benefits of diversification existed before Subprime crisis in 2007.

Lee and Isa (2014) used weekly data from January 2000 until December 2011 to study the integration among 22 international markets (Asia/Pacific, Europe, America), from the view of Malaysian investors. They analysed the impact of subprime crisis in 2007 on the links between these markets. Johansen cointegration test revealed lack of correlation between these markets, Causality test showed that Malaysian market had weak correlation with other emerging and developed markets in Asia/Pacific. In addition, Malaysian stock market did not respond to shocks in other markets, so shocks in other markets had a marginal impact on the interpretation of fluctuations in the Malaysian market; hence, there are benefits for local investors to invest in international markets.

Lau and Yarovaga (2016) studied comovement among stock markets in recent crisis and discovered the benefits of international investment portfolios diversification that are available to investors in the United Kingdom; BRICS markets (China, India, Brazil, Russia and South Africa) and MIST markets (Mexico, Indonesia, South Korea and Turkey). Results of Johansen cointegration and Granger causality revealed lack of diversification opportunities between UK market and other markets, while AG-DCC model demonstrates variations in comovement between the markets. They also found an evidence of cointegtation of UK market with (Brazil, South Africa and Mexico) and these three markets are vulnerable to shocks that occur in the UK market. It seemed that UK market and (India, Indonesia and South Korea) markets had strong correlation rather than contagion. Moreover, results revealed that China market is less affected by positive or negative shocks from UK market, thus China market is the most attractive market for investors in United Kingdom market.

AK-Nasser and Hajilee (2016) verified the integration of stock markets in five emerging markets (Brazil, China, Mexico, Russia and Turkey) and three developed markets (USA, UK, and Germany). They used Bounds testing approach to test cointegration among these markets and error correction model. These tests are applied to monthly data from January 2001 until December 2014 in order to check for short and long run relationship between returns in both emerging and developed markets. The results revealed cointegration in short term among stock markets in both emerging and developed countries. With regard to long term integration, the results showed that returns in emerging markets had statistically significant relationship with returns on Germany stock market. Therefore, investors in both UK and USA can realize abnormal profits and diversify their portfolios in emerging markets.

3. DATA AND RESEARCH METHODS

3.1. Data

To investigate the integration between DSE market and other markets, this study used monthly data over the period 2010-2015. Data for each index are obtained from its corresponding website as follows:

- DSE index from www.dse.sy
- ASE index from www.ase.com.jo
- ISE index from www.isx.-iq.net
- DAX and CAC40 from www.finance.yahoo.com

All the data are transformed into logarithm (LN) in order to achieve mean-reverting relationships, and to make econometric testing procedures valid. We also used local currency for each index as the case of many studies (e.g. (Marashdeh, 2006; Heilmann, 2010; Poldauf, 2011; Gupta and Guidi, 2012)). This is done to avoid problems associated with transformation due to fluctuations in exchange rates. Following (Aggarwal and Kyaw, 2005; Altin and Sahin, 2010; Yang *et al.*, 2014; Chein *et al.*, 2015) we used monthly prices indices to test integration between DSE and the other markets.

3.2. Methodology

In previous studies shown in the literature review, many methods to investigate the integration among stock markets are used such as ICAPM, Cointegration, Correlation and Time Varying estimates. In this study Johansen cointegration test is adopted. This test permits more than one cointegration relationship and is more applicable and reliable than other conventional cointegration approaches. In addition, it is applied irrespective of the order of integration of the time series and is considered more robust and performs well for large sample sizes (Atyeh and AL-Rashed, 2013). This section is divided into five tests.

3.2.1. Stationary of Series

A precondition to perform a cointegration test is that the order of integration of variables has to be the same (Gupta and Guidi, 2012). Therefore, it need to investigate stationary of each variable and determine order of integration. To do so we used Augmented Dickey-Fuller (ADF) and Philips-Perron (PP).

The equations of the ADF test are:

$$\Delta x_t = a_0 + \gamma x_{t-1} + \sum_{i=1}^{p} \beta\, x_{t-i} + \varepsilon_t \qquad (1) \text{ With constant}$$

$$\Delta x_t = a_0 + \gamma x_{t-1} + \delta + \sum_{i=1}^{p} \beta\, x_{t-i} + \varepsilon_t \qquad (2) \text{ With constant and trend}$$

$$\Delta x_t = \gamma x_{t-1} + \sum_{i=1}^{p} \beta\, x_{t-i} + \varepsilon_t \qquad (3) \text{ Without constant or trend}$$

Where: a_0 is constant, δ is the trend and ε_t is error term.

The null hypothesis is that the variable has unit root, the alternative hypothesis is that variable is stationary.

The distribution theory supporting Dickey-Fuller tests assumes that the errors are statically independent and have a constant variance. This may not be the case with some of data used. Fortunately, an alternative test PP allows the error disturbances to be weakly dependent and heterogeneously distributed (Aggarwal and Kyaw, 2005).

$$x_t = a_0 + a_1 x_{t-1} + a_2\left(t - \frac{T}{2}\right) + \epsilon_t \qquad (4)$$

Test statistics for the regression coefficient under null hypothesis is that the data are generated by: $x_t = x_{t-1} + \varepsilon_t$ (5)

where $E(\varepsilon_t)=0$ (Aggarwal and Kyaw, 2005).

If the series are non-stationary and integrated at the same order, we can run Johansen cointegration test.

3.2.2. Johansen Cointegration Approach

The concept of cointegration rests on works of Granger (1981); Engle and Granger (1987) which deals with the relation between non-stationary time series sharing a common stochastic trend (Heilmann, 2010). When we have two time series we have one cointegrating vector, but if there are more than two time series in the cointegration regression, there may be more than one cointegrating vector. Thus, more appropriate method for testing cointegration in a multivariate setting has been developed by Johansen (1988; 1991); Johansen and Juselius (1990). Johansen derives the maximum likelihood estimator of the cointegration space. Test is based on the likelihood ratio (LR) test of the hypothesis that the cointegration space is restricted to lie in a certain subspace.

As a result, Johansen cointegration test enables determining of the number of cointegration relationship and its parameters (Toraman and Basarir, 2014).

The Johansen test relies on the VAR process:

$$\Delta x_t = \sum_{i=1}^{k-1} \Gamma_i \Delta x_{t-1} + \prod x_{t-1} + \mu + \varepsilon_t \qquad (6)$$

where:

t=0,…,T

i=1,..,k-1

Γ_i=-I+ $\prod_1$+….+$\prod_i$ (7)

$\prod$ = -(I- $\prod_1$-$\prod_2$-…- $\prod_k$) (8)

where:

Δ : First difference operator

x_t : Vector cointegrating the stock market indices in log form

μ : Drift parameter

The impact matrix $\prod$ can be decomposed as : α is the matrix of the short run adjustement coefficient to the cointegration vectors (the βmatrix).

There are two alternative tests statistic for the rank of $\prod$ in Johansen model: (Chein *et al.*, 2015)

$\lambda_{trace} = -T\sum_{isr+1}^{k}\ln(1-\lambda_i)$ (9) [Trace statistic]

$\lambda_{\max(r+1)} = -T\ln(1-\lambda_{r+1})$ (10) [Maximum Eigen value statistic]

Where: $\lambda_i$eigen values of the estimated $\prod$ matrix

T is the number of usable observation

From equation (9): the estimated eigen values are λ_1>λ_2>λ_3…λ_k and r ranges from 0 to k-1 depending upon the stage in the sequence. The null hypothesis is r $\leq r_0$ against the alternative one r $\geq r_0 + 1$.

$\lambda_{\max}$is closely related to the trace statistic, but arises from changing the alternative hypothesis from r $\geq r_0 + 1$ to r $= r_0$ +1. The idea is to improve the power of the test by limiting the alternative to a cointegrating rank, which is higher than the null hypothesis by one. Null hypothesis is that there are r cointegrating vectors, against the alternative r+1 cointegrating vectors.

3.2.3. Error Correction Model

To clarify the degree of transition and vulnerability (fast or low) by markets indices to DSE market, we used Error Correction Model. The concept Error Correction Model is based on the existence of long-term equilibrium relationship between variables; this relationship determines the equilibrium value of dependent variable.

Despite the existence of this equilibrium relation in long term, it is rarely realized because the dependent variable may take different values from its equilibrium value. Moreover, it represents the difference between two values at each period (equilibrium error) and it is adjusting (correcting) this error or part of long-term relation. This is why it is named Error Correction Model (ECM).

By using ECM we examine and analysis the behavior of variables in short term in order to reach equilibrium in the long term. As a result, when variables are cointegrated by VAR model, we can use ECM to determine the direction of the causal relationship and estimate the speed of conditional equilibrium in the short term to get a long-term trend among variables.

To estimate ECM we use the equation:

$\Delta y_t = \delta\Delta z_{t-1} + \sum_{i=0}^{p} a_i\Delta x_{t-1} + \sum_{j=1}^{p} b_j\Delta x_{t-j} + \varepsilon_t$ (11)

Where: $z_{t-1} = x_{t-1} - a - \beta y_{t-1}$ (12)

δ Coefficient speed of adjusted equilibrium

The null hypothesis is δ<0, that means there is long run association ship between two variables.

3.2.4. Vector Error Correction Model

The VECM is used to test response degree of DSE index to changes in other indices. Estimations of VECM can be done by standard OLS or using maximum likelihood approach. Engle and Granger (1987) proposed a two- stage method which at first estimates the cointegrating vector by regressing on time series in the system on remaining variables. In a second step, the estimated cointegrating vector is used to estimate equation (Heilmann, 2010).

On the other hand, the maximum likelihood method developed By Johansen (1988) it is a full information approach that estimates the VECM in a single step. This procedure has the advantage of not carry over estimation errors of the first step into the second one, and therefore yields more efficient estimators (Heilmann, 2010).

The cointegrated variables must follow the Vector Error Correction representation:

$$\Delta y_t = \mu + \delta t + \Pi y_{t-1} + \sum_{s=1}^{p} \Gamma_s \Delta y_{t-s} + \varepsilon_t \quad (13)$$

Where: $\Pi = -(Ik - A_1 - A_2 \ldots - A_p)$ (14)

$$\Gamma_i = -(A_{i+1} + A_{i+2} + \cdots + A_p) \quad (15)$$

i=1,2,…,p

μ constant

A sequence represents (p-1)(k*k) matrix.

From VECM, Impulse Response Function (IRF) is used to know the response of the dependent variable in VECM system to shocks in error terms (Gujarati, 2003). In addition, Forecast Error Variance Decomposition is used to indicate the amount of information each variable contributes to other variables in VECM model. Furthermore, this approach shows which variable affects the series against a shock and it gives the forecast for next period (Altin and Sahin, 2010).

3.2.5. Granger Causality

According to Granger (1969) the variable **y** is said to Granger Cause the variable **x,** if and only if, x is better predicted by using the past values of **y** than by not doing so with the past values of **x** being used in either case. However, if **y** does not cause **x** and **x** does not cause **y**, then **y** and **x** are statistically independent (Georgantopoulos, 2013).

In other words, **x** causes **y** when the arrow points the direction of causality. The Granger Causality test assumes that the information relevant to prediction of the respective variables, **x** and **y**, is contained solely in the time series data of the variables (Gujarati, 2003).

The VAR in the first difference can be written as:

$$\Delta x_t = \lambda_1 + \sum_{i=1}^{k} a_{1j} \Delta x_{t-i} + \sum_{j=1}^{k} b_{1j} \Delta y_{t-j} + \mu_{1t} \quad (16)$$

$$\Delta y_t = \lambda_2 + \sum_{i=1}^{p} a_{2j} \Delta x_{t-i} + \sum_{j=1}^{p} b_{2j} \Delta y_{t-j} + \mu_{2t} \quad (17)$$

After estimating the Granger Causality, we can run an F-test for joint insignificance of the coefficients. Assuming the null hypothesis that x_t does not Granger Cause y_t, and vice versa. A rejection of null hypothesis shows a presence of Granger Causality (Gupta and Guidi, 2012) Granger Causality tests are performed for each pair of stock indices.

3.3. Research Results

Table (1) reports the descriptive statistics for the sample of the indices from January 2010 until December 2015 in natural logarithm, and figure (1) displays graphs of the natural log of the indices.

Table-1..Descriptive Statistic of the Data:

	LnDSE	LnISE	LnASE	LnDAX	LnCAC40
mean	7.036078	4.989761	7.653414	8.978395	8.178953
median	7.099598	4.764477	7.654205	8.945954	8.284323
maximum	7.451613	6.908315	7.853605	9.389838	8.533578
minimum	6.645871	4.118387	7.523481	8.612871	8.000333
Std.Dev	0.221363	0.728768	0.077403	0.221114	0.138782
skewness	-0.196009	1.909312	0.585197	0.165749	0.012924
kurtosis	2.228587	5.051714	2.912935	1.796684	2.147935
Jarque-Bera	2.246268	56.37427	4.132211	4.673583	2.180050
probability	0.325259	0	0.126678	0.096637	0.336208
sum	5065976	359.2628	551.0458	646.4444	596.0846
Sum Sq.Dev	3.479113	37.70834	0.425374	3.471279	1.367484
observation	72	72	72	72	72

Note: The variables are measured in natural logarithm

Source: form Eviews.

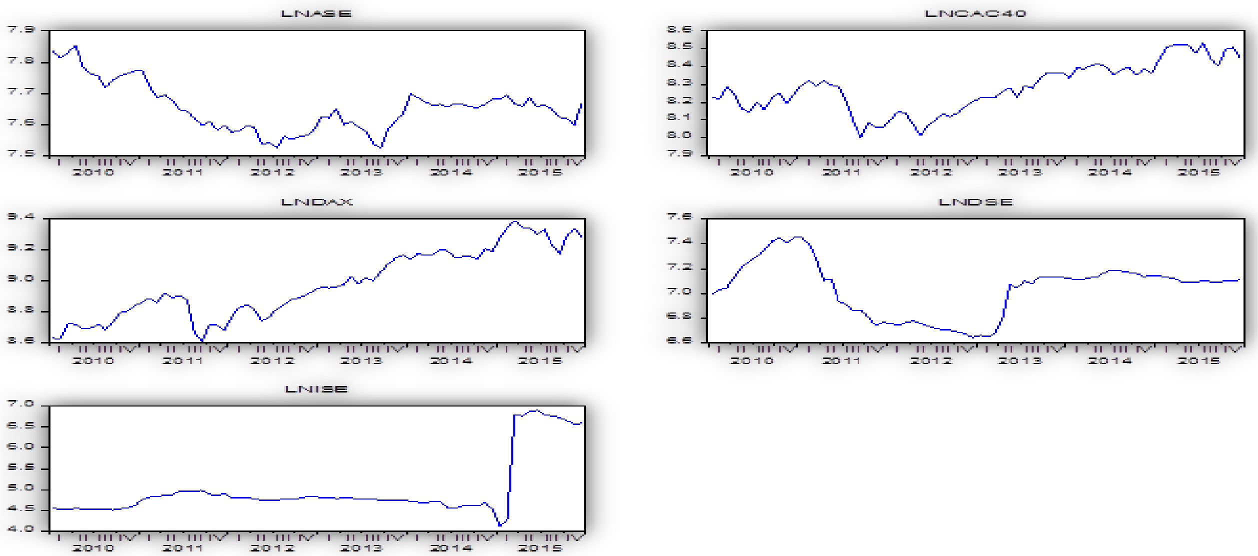

Figure-1. The natural log of the indices:

Source: From Eviews7.

3.3.1. Unit Root Test

Before any cointegration analysis can be done, we have to investigate that all the variables are integrated at the same order to avoid spurious regression (Ismaiel and Khzam, 2015). The results of ADF and PP tests, at level and in first difference of the data with intercept; with trend and intercept; and with no trend or intercept, are shown in tables (2) and (3). The tests have been performed based on 5 percent significance level, using Mackinnon critical values. In addition, Akaike Information Criteria select the optimal lag length.

Table-2. Augmented Dickey-Fuller Test

Variables and critical value	Test with intercept				Trend and intercept				No trend no intercept			
	level	**lag**	**1.diff**	**lag**	**level**	**lag**	**1.diff**	**lag**	**level**	**lag**	**1.diff**	**lag**
LnDSE	-2.102234	2	**-3.434454****	1	-2.078902	2	**-3.414502****	1	-0.021519	2	**-3.460521****	1
LnISE	-1.191642	0	**-7.985738****	0	-1.939605	0	**-7.991525****	0	0.606151	0	**-7.975403****	0
LnASE	-2.460845	0	**-7.978127****	0	-1.984896	0	**-8.153110****	0	-0.768485	0	**-7.993878****	0
LnDAX	-1.132126	0	**-7.149191****	1	-2.695732	0	**-7.095406****	1	1.468076	0	**-6.919999****	1
LnCAC40	-1.218251	0	**-8.166345****	0	-2.281097	0	**-8.122576****	0	0.518000	0	**-8.189661****	0

MacKinnon (1996) one –sided p-value

** Denotes to reject the null hypothesis at 5 percent, the optimal lag length is selected by Akaike Information Criteria (maximum lag =11).

Source: From Eviews7.

Table-3. Philips-Perron Test

Variables	Test with intercept		Trend and intercept		No trend no intercept	
	level	**1.diff**	**level**	**1.diff**	**level**	**1.diff**
LnDSE	-1.681770	**-6.008743****	-1.674921	**-5.967185****	0.113292	**-6.047237****
LnISE	-1.277525	**-8.006729****	-2.035933	**-8.032887****	0.703000	**-7.973155****
LnASE	-2.460538	**--7.981995****	-1.984896	**-8.153110****	-0.775053	**-7.997238****
LnDAX	-1.106997	**-7.803764****	-2.832972	**-7.738959****	1.585373	**-7.615645****
LnCAC40	-1.218251	**-8.160232****	-2.281097	**-8.115500****	0.552211	**-8.185217****

MacKinnon (1996) one –sided p-value

** Denotes to reject the null hypothesis at 5 percent

Source: From Eviews7

According to the tests, all indices have a unit root at level, but they become stationary in first difference, therefore all five series follow I(1) processes.

3.3.2. Cointegration Johansen Test

To check if there is long-run relationship among five series, cointegration Johansen test is used. At first, we have to choose optimal lag. We used VAR model to select optimum lag from lag length criteria as shown in table (4). The values of (LR, FPE, AIC, SC, HQ) suggested the selection of 1 lag.

Table-4. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	219.7290	NA	1.03e-09	-6.506940	-6.341057	-6.441392
1	508.9486	525.8538*	3.43e-13*	-14.51359*	-13.51830*	-14.12031*
2	524.1037	25.25847	4.69e-13	-14.21526	-12.39055	-13.49423
3	542.9595	28.56938	5.84e-13	-14.02908	-11.37495	-12.98030
4	554.5014	15.73891	9.37e-13	-13.62125	-10.13771	-12.24474
5	576.5488	26.72418	1.14e-12	-13.53179	-9.218826	-11.82753
6	599.7720	24.63066	1.44e-12	-13.47794	-8.335568	-11.44594

*indicates lag order selected by the criterion

Source: From Eviews7

Tables (5) and (6) show the results of Johansen test with lag (1) and dummy variable as an exogenous variable. The testing hypothesis is the null hypothesis of no cointegration against the alternative one that suggests the existence of cointegration, using the maximum likelihood procedure. the first test that is trace test reject the null hypothesis of no cointegration at 5 percent significance level, so there is at most one cointegration vector. On the other hand, the second test, which is maximum eigen value, also assumes that there is at most one cointegration vector. As a result, there is long-run relationship between DSE and (ASE, ISE, DAX, CAC40).

Table-5. Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE (s)	Eigen value	Trace Statistic	Critical Value	Prob**
None*	0.45676	90.04893	69.81889	0.0005
At most 1	0.308180	47.33380	47.85613	0.0559
At most 2	0.169966	21.503494	29.79707	0.3246

Trace test indicates 1cointegratingequ at 0.05 level

*denotes the rejection of hypothesis at 0.05 level

**Mackinnon *et al.* (1999) p-value

Source: From Eviews7

Table-6. Unrestricted Cointegration Rank Test (Maximum Eigen Value)

Hypothesized No.of CE (s)	Eigenvalue	Max-Eigen statistic	Critical Value 0.05	Prob**
None*	0.45676	42.71513	33.87687	0.0034
At most 1	0.308180	25.79008	27.58434	0.0833
At most 2	0.169966	13.04023	21.13162	0.4485

Max-Eigen value test indicates 1cointegratingequ at 0.05 level

*denotes the rejection of hypothesis at 0.05 level

**Mackinnon *et al.* (1999) p-value

Source: From Eviews7

According to the two tests, there is one cointegration vector at 0.05 level, consequently those markets move together in the long-run.

From tables (5, 6) we can write the cointegration equation as below:

LNDSE= (-0.182020) LNISE+ (-2.489451) LNASE+ (0.959616) LNDAX+ (1.093862) LNCAC40

In addition, a cointegration equation is used for the direction of the markets based on coefficient signs. Thus there is positive long-run relationship between DSE and (DAX, CAC40), and there is negative long run relationship between DSE and (ASE, IAE). As the equation shows, ASE index is the most elastic among them, thus 1% increase in ASE index causes 2.489451 deduction in DSE index, but ISE index is the least elastic among them. Which means 1% increase in ISE index causes 0.182020 deduction in DSE.

3.3.3. Error Correction Model

WAe use ECM to clarify the degree of transition and vulnerability (fast or low) of markets indices to DSE market. Having found a long-term relationship between DSE and other indices, we estimated a VAR model that shows a mechanism of error correction model. Table (7) shows the estimates regarding the form of the error correction model. As table (7) shows, the error correction term is negative and statistically significant, which confirms that there is no problem in the long-run equilibrium relationship between DSE and other indices.

Table-7. Error Correction Model

Error Correction	D(LNDSE)	D(LNISE)	D(LNASE)	D(LNDAX)	D(LNCAC40)
Coefficient	-0.161638	-0.348101	-0.061077	-0.017023	-0.038838
Standard error	0.03467	0.22632	0.01783	0.03781	0.03517
T.Statistic	-4.66164	-1.53807	-3.42536	-0.45017	-1.10442

R-squared	0.359811	Mean dependent	0.001226
Adj.Rsquared	0.287532	S.D dependent	0.057551
Sum sq.resids	0.146306	Hannan- Quinn criteria	-3.002028
F. statistic	4.978063	Akaik AIC	-3.104100
Prob(F.Statistic)	0.000163	Schwarz SC	-2.847129
		Durbin Waston statistic	2.094244

Source: From Eviews7

As a result, we can write the equation that reflects the relationship between DSE and independent variables in long and short term from VECM as below:

ΔlnDSE(-1)= -0.161[lnDSE(-1)+ 0.182lnISE (-1)+2.48lnASE(-1)-0.959lnDAX(-1) -1.093862 lnCAC40(-1) -9.316085)] +0.12 D(lnDSE(-1)) -0.013841 D(lnISE(-1)) -0.274 D(lnASE(-1)) -0.139 D(lnDAX(-1)) -0.07 D(lnCAC40(-1)) + 0.15482 -0.184*dummy (18)

From the ECM model, DSE index is corrected by 16% from the disruption of the equilibrium value of all the past. That is, when deviates in the short term in the period t-1 of the equilibrium value in the long term; it is corrected by 16% of this disruption in the period t. The correction ratio reflects very low speed of adjustment towards equilibrium, where DSE index needs (1/0.16=6 months) to reach the equilibrium value when there is an internal shock.

The same for ASE index, it needs 16 months to reach the equilibrium value. This reflects very low speed adjustment towards equilibrium.

On the other hand, from the last equation in the short term, there is not short run equilibrium between DSE and independent variables, because the coefficients are not statistically significant. However, Dummy variable is negative and significant; this assumes there is an effect to Syrian crisis on the relationship between DSE and the other markets as table (8) shows.

Table-8. Dependent variable D (LNDSE)

D(LNDSE)=C(1)*(LNDSE(-1))+0.182020314878LNISE(-1)+2.4894507365*LNASE(-1)-0.959616229709*LNDAX(-1)-1.09386176897*LNCAC40(-1)-9.31608542062) +C(2)*D(LNDSE(-1)) +C(3)*D(LNISE(-1))+ C(4)*D(LNASE(-1))+ C(5)*D(LNDAX(-1))+ C(6)*D(LNCAC40(-1))+ C(7)+ C(8)*DUMMY

	Coefficient	Std.error	T.statistic	Prob
C(1)	-0.161638	0.034674	-4.661642	0.0000
C(2)	0.123275	0.111598	1.104630	0.2736
C(3)	-0.013841	0.018861	-0.733862	0.4658
C(4)	-0.274394	0.250359	-1.096004	0.2773
C(5)	-0.139318	0.220918	-0.030633	0.5306
C(6)	-0.070011	0.241078	-0.290406	0.7725
C(7)	0.154820	0.032550	4.756439	0.0000
C(8)	-0.184198	0.038188	-4.823430	0.0000

Source: From Eviews7

As a result, in the long-term there is long run relationship equilibrium between DSE and other markets, but in the short term the relationship is absent. In addition, DSE reflects very low speed of adjustment toward equilibrium value.

3.3.4. Vecm

Before applying forecast tests, we have to verify the validity of VECM model. First, table (7) shows R squared=0.359811, that means our model explains just 35.98% of the variations of DSE index. Although the proportion is low however F statistic= 4.978063 and prob= 0.000164. That means this value is significant at 1%, 5% and 10%. In addition, Durbin Waston statistic= 2.094244 (which is between 1.8 and 2.2), this implies the absence of autocorrelation. We conclude that the independent variables introduced in this model are jointly significant in explaining the variations in DSE index.

On the other hand, the results of the residual tests are:

- Autocorrelation LM test with lags=12: as we note in table (9) prob> 0.05 that means we accept null hypothesis and there is no serial correlation.

- White Heteroscedasticity (No Cross Terms): the possible existence of Heteroscedasticity is a major concern in the application of regression analysis (Evans, 2013) because the presence of Heteroscedasticity can invalidate statistical tests of significance, which assumes the modelling errors are uncorrelated and their variances do not vary with the effects being modelled. As the table (10) shows, we can reject the null hypothesis that the VECM is Heteroscedasticity.

Table-9. VEC Residual Serial Correlation LM test Null hypothesis: no serial correaltion

lags	LM-Stat	Prob
1	20.25219	0.7335
2	23.56011	0.5449
3	16.30134	0.9056
4	23.92944	0.5235
5	21.34547	0.6732
6	26.68691	0.3717
7	16.94765	0.8837
8	14.72743	0.9475
9	31.38934	0.1764
10	12.31018	0.9839
11	13.90955	0.9633
12	22.73381	0.5931

Source: From Eviews7

Table-10. VEC Residual Heteroscedasticity Tests: No Cross Terms (only levels and squares)

Joint test		
Chi-sq	df	Prob
236.6304	195	0.0223

Source: From Eviews7

- Normality test (Cholesky of Covariance): from table (11), the variables are not normally distributed.

Table-11. VEC Residual Normality Tests Orthogonalization: Cholesky (Lutkepohl) Null hypothesis: residuals are multivariate normal

	Chi-sq	df	prob
Skewness	533.5218	5	0.000
Kurtosis	7000.236	5	0.000
Jarque-Bera	7533.758	10	0.000

Source: From Eviews7

We can conclude that the results are good for policy analysis and predictions.

3.3.4.1. Impulse Response Function

An impulse response refers to the reaction of any dynamic in response to some external change. In both cases, the impulse response describes the reaction of the system as a function of time (Evans, 2013). Figure (2) displays the response of DSE index to an innovation shock of the indices used in the model, thus a shock in DSE index causes a positive effect on DSE index (own shock). At period (1), one standard deviation increase on DSE causes 0.045 increase on DSE at one-month forecast horizon.

On the other hand, DSE index reacts negatively to ISE and ASE. A shock on ISE causes a negative impact on DSE starts from 1st month to the 10th month. DSE starts to react negatively to the shock but with low values of multipliers on first month (0.009) in second period, then the deduction increases after 3 months up to 0.026 after 10 months.

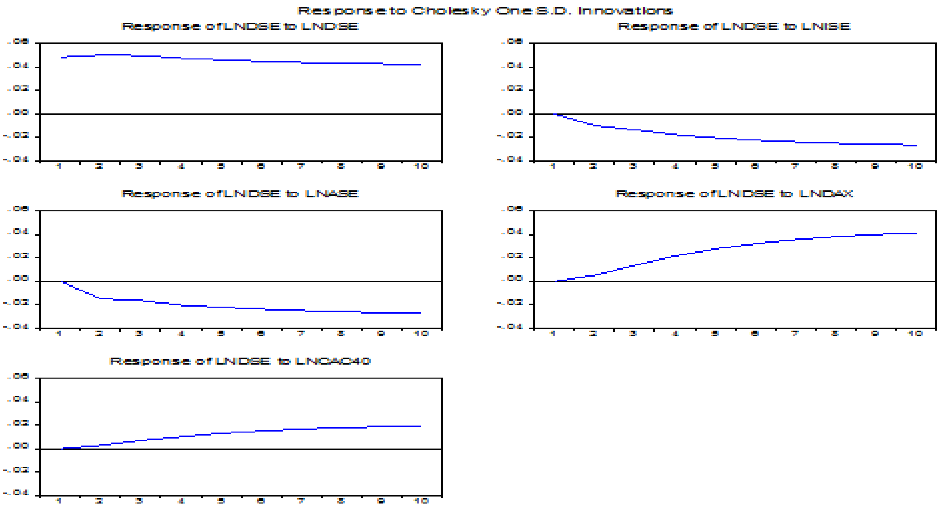

Figure-2. Impulse Response Function

Source: From Eviews7

The results of Arab markets show that shock on them causes negative impact on DSE on the short and long term. However, for international markets, DSE index reacts positively to the shock on their indices namely DAX and CAC40 and reaches the equilibrium level again.

3.3.4.2. Error Forecast Variance Decomposition

Variance Decomposition indicates the amount of information each variable contributes to other variables in Vector Autoregressive model (VAR). In addition, this approach shows which variable affects the series against a shock, this gives the forecast of the next period (Altin and Sahin, 2010; Evans, 2013).

As it is shown in table (12), 52.76 of variance decomposition in DSE is endogenous. It starts with 93% on second month and decreases to 52.76 on 10th month. However, other markets reflect weak interpretation in DSE index. Thus, a shock on ISE index explains 6.1% of the variation in DSE index at 6 months forecast horizon, and 9.911 of the variation in DSE at 10 months forecast horizon.

In addition, a shock on DAX index explains around 5.63% of the variation on DSE index after a month, and this percentage increases over 10 months to become 21.08%.

Table-12. Variance Decomposition of LNDSE

period	S.E	LNDSE	LNISE	LNASE	LNDAX	LNCAC40
1	0.048578	100.0000	0.000000	0.000000	0.0000	0.000000
2	0.072450	93.26484	1.815728	4.270176	0.518182	0.131076
3	0.091863	87.74844	3.288323	5.850657	2.481161	0.631419
4	0.109502	80.69660	4.856511	7.538444	5.632623	1.275821
5	0.126294	74.06467	6.190146	8.712644	9.025302	2.007234
6	0.142453	68.17680	7.290145	9.651603	12.20088	2.680573
7	0.157998	63.20763	8.172188	10.35250	14.99051	3.277171
8	0.172928	59.06314	8.880653	10.89623	17.37429	3.785693
9	0.187245	55.62638	9.451643	11.31802	19.38800	4.215964
10	0.200962	52.76877	9.916159	11.65223	21.08452	4.578321
Cholesky Ordering: LNDSE LNISE LNASE LNDAX LNCAC40						

Source: From Eviews7

3.3.5. Granger Causality

The results of Granger Causality test are shown on table (13). The results show that there is no relationship between the markets. As we found in VECM, Granger Causality confirms these results at short term.

Table-13. VEC Granger Causality/Block Exogeneity Wald Test

Dependent Variable: D (LNDSE)			
variables	**Chi-sq**	**lag**	**prop**
D(LNISE)	0.538554	1	0.4630
D(LNASE)	1.201226	1	0.2731
D(LNDAX)	0.397698	1	0.5283
D(LNCAC40)	0.084336	1	0.7715
All	4.977827	4	0.2896
Dependent Variable: D(LnISE)			
D(LNDSE)	0.789656	1	0.3742
D(LNASE)	0.068288	1	0.7938
D(LNDAX)	0.449834	1	0.5024
D(LNCAC40)	1.182227	4	0.2769
ALL	2.168225		0.7049
Dependent variable: D(LNASE)			
D(LNDSE)	2.331038	1	0.1268
D(LNISE)	0.945730	1	0.3308
D(LNDAX)	1.832656	1	0.1758
D(LNCAC40)	1.794176	1	0.1804
ALL	5.119582	4	0.2752
Dependent variable: D(LNDAX)			
D(LNDSE)	0.000136	1	0.9907
D(LNISE)	1.025139	1	0.3113
D(LNASE)	0.433634	1	0.5102
D(LNCAC40)	1.601430	1	0.2057
ALL	2.968218	4	0.5632
Dependent variable: D(LNCAC40)			
D(LNDSE)	0.041523	1	0.8385
D(LNISE)	0.086253	1	0.7690
D(LNASE)	1.416615	1	0.2340
D(LNDAX)	0.371530	1	0.5422
ALL	1.983571	4	0.7388

Source: From Eviews7

4. CONCLUSION

This study investigated the integration between Damascus Stock Exchange with Arab stock markets namely (Jordan and Iraq) and with International stock markets namely (France and Germany), for the period 2010-2015 using monthly stock prices and considering Syrian crises by introduced it as a dummy variable.

This research found that there is long-run relationship among the markets as cointegration results showed. This means the markets move together on long term. In another words, LOOP is hold on long term. In addition, DSE reacts slowly to the variations on other markets, and Syrian crises had negative and significant effect on the relation between DSE and the other markets. Although there is a lack of arbitrage opportunities in these markets on long term, but on short-term investors can still achieve arbitrage profits through portfolio diversification as Granger causality test revealed the absence of causal relation among the markets.

These results are of great important to investors wishing to diversify their portfolios, managers and policy makers interested in these markets. We recommend for future research to introduce control variables such as (inflation, export, import, exchange rate, interest rate…) and explain how these variables effect on the relations among the markets.

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