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Testing the efficiency of Amman Stock Exchange by the two step regression based technique, the Johansen multivariate technique cointegration, and Granger causality

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The main objective of this study is to test whether Amman Stock Exchange (ASE) is efficient at the weak-form. This study investigates any significant relation between the five indices of the Jordan market; General Index, Industrial Index, Insurance Index, Service Index and the Bank Index. The analysis of the performance of the Jordan equity market presented in this study is carried out through the Two Step Regression Based Technique, The Johansen Multivariate Technique cointegration, and Granger causality. Our results oppose the previous findings which proposed that the Jordan market is not weak form efficient.

keywords: The Efficient Market Hypothesis, Amman Stock Exchange, Market efficiency, random walk, The Two Step Regression Based Technique, The Johansen Multivariate Technique cointegration, and Granger causality.

1 Introduction

The integration of the world major stock markets, which is a broad concept, has attracted a great deal of interest recently. Consequently, considerable advances have been

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made in its empirical methods. A greater degree of co-movements displayed by equity markets over time is usually seen as a reflection of greater stock market integration. In cointegration in international stock price movements, national stock prices may not be stationary; however, some combinations of these stock prices may be stationary. Two price indices with a unit root are considered to be cointegrated when a linear combination of them does not have a unit root. Thus, it could be concluded that while each of the two price indices are non-stationary, their non-stationarity is offsetting, and for that reason it can be inferred that the two price indices are in a long-run relationship. The relevance of the concept of cointegration for semi-strong market efficiency applies in the view of the fact that if two variables are related in the long run, then one variable can be used to forecast the other (even if each of them is unpredictable on the basis of its own past). This is a clear violation of the semi-strong Efficient Market Hypothesis (EMH) proposed by Malkiel and Fama (1970). When national equity markets are cointegrated, the gain from international diversification is limited due to the presence of common factors which controls the amount of independent variation. The absence of cointegration does not only indicate that such variables have no long-run link but also that transnational investments in stock markets can potentially improve portfolio's diversification. The existence of lead-lag relationships between stock exchanges, equity market integration in terms of pricing efficiency, and international diversification of portfolios have been the subject of considerable investigation in the literature (see for example, King and Wadhwani, 1990; Jeon and VONFURSTENBERG, 1990; Arshanapalli and Doukas, 1993; Eun and Shim, 1989; Kasa, 1992). Despite the fact that emerging markets of developing countries have recently attracted considerable attention (Bekaert and Harvey, 1997, De Santis et al., 1997), Bekaert and Harvey (1997) argue that even though the returns of stock markets in emerging markets are high and predictable, they have no strong correlation with major markets. Emerging markets are expected to gradually become more sensitive to the volatility of stock markets worldwide as they mature. While their integration with world markets improves, their ability to enhance and diversify international portfolios diminishes. Therefore, the concept of market integration has been the concern of both equity investors and companies that make capital budgeting decisions. Portfolio theory proposes that the greater the degree of integration of stock markets, the lesser the returns from international diversification are going to be. Then again, if individual national markets exhibit inefficiency, there will be profitable arbitrage opportunities for international portfolio investment.

2 Cointegration Methodology

The theory of cointegration, which was developed by Granger (1981) and elaborated by Engle and Granger (1987), is a useful tool to test the concept of "efficiency". Cointegration techniques are used to identify the long run structural relationship among the variables under study. In other words, this theory attempts to determine whether in the long run the variables under consideration would move in the same direction or not. A joint null hypothesis was developed based on Fama's Efficient Market Hypothesis which suggests that a market is efficient if all prices fully reflect all relevant information. This null hypothesis was developed on the postulation that the market participants use all available information in a controlled manner, and that there is constancy in the expected equilibrium returns. However, when this hypothesis is put into practice, the prices of various shares cannot be cointegrated. According to MacDonald and Power (1993), if time series prices are cointegrated, Granger-causality runs in at least one direction between the different price series which will enable one share price to forecast the others. In light of the above, the share price either does not reflect all available information or there are significant deviations in the expected returns.

Non-stationary two time series, on the other hand, are cointegrated if there is a stationary linear combination of them providing it does not have a stochastic trend. This indicates that the series do not wander off from each other and so there is a long run equilibrium relationship between them. Cointegration in this case is the statistical equivalent of the existence of a long run economic relationship between I(1) variables which implies the existence of a long run equilibrium relationship. Consequently, if X_t and Y_t series are both integrated of order one I(1) and the linear combination Z_t given by (1-1) is integrated to order zero I(0) , then X_t and Y_t are said to be cointegrated with being the cointegrating parameter.

$$Z_t = Y_t - \alpha X_t \tag{1}$$

Since equilibrium is a maintained relationship between a set of variables, Z_t given by (1-1) would be considered as an equilibrium error as it measures the degree to which the system is out of equilibrium. Because Z_t is stationary in case of cointegration, which means I(0), Z_t rarely stray from zero and often crosses the zero line if it has zero mean, which will cause equilibrium to occasionally occur. If Z_t is I(1), then X_t and Y_t are not cointegrated, so the equilibrium error can wander widely and zero crossing would be uncommon.

It is likely to have up to $N-1$ stationary linear combination or cointegrating vectors for a group of non-stationary series N I(1). The existence of a cointegrating relationship among a vector of variables implies the existence of error correction representation, which MacDonald and Power (1993) expressed as:

$$(1-L)\Delta X_t = -\rho Z_{t-1} + \epsilon_t \tag{2}$$

Where X is a $N \times 1$ vector of I(1) variables, Z represents the error correction term, L denotes the lag operator and denotes a vector of residuals. Since the past prices cannot be exploited to improve the forecasts of the current prices by applying the efficient market hypothesis, the equation (1-2) expresses a violation of market efficiency. And so, the existence of cointegration among stock prices is a solid evidence of static inefficiency (MacDonald and Power, 1993). The Two-Step Regression Based Technique proposed by Engle and Granger (1987) and the Johansen Multivariate Technique are used to test for cointegration. These two techniques are outlined below.

3 The Two Step Regression Based Technique

This technique, which was proposed by Engle and Granger, employs OLS to look for a linear combination of level series that minimizes the variance of the linear combination. Using this technique, a cointegrating regression given by (1-3) for the potential cointegration set is estimated through employing OLS. Whereas, the stationarity of the residuals for this cointegrating regression is examined through applying:

- Durbin Watson test for the cointegration regression given by (1-3)

$$y_t = c + \alpha x_t + u_t \tag{3}$$

- Dickey Fuller test for the regression given by (1-4)

$$\Delta u_t = \Phi u_{t-1} + \epsilon_t \tag{4}$$

- Augmented Dickey Fuller test for the regression given by (1-5)

$$\Delta u_t = -\Phi u_{t-1} + b_1 \Delta u_{t-1} + ... + b_p \Delta u_{t-p} + \epsilon_t \tag{5}$$

The statistics tabulated by Engle and Granger are used as the distributions of these statistics are nonstandard.

In spite of the potentially powerful results of the Engle Granger Two Step Regression Based technique and its inherent simplicity, it has been argued that this procedure suffers from a number of deficiencies. For instance, performing the cointegrating regression in different ways can generate different results for each alternative. It is possible to run the Engle-Granger test in the case of two variables, if we take into consideration that the estimation of the long run equilibrium regression requires one variable to be placed on the LHS and the others used as regressors, by using the residuals from either side of the following two "equilibrium" regressions:

$$y_t = c_1 + \alpha_1 x_t + u_{1t} \tag{6}$$

or

$$y_t = c_2 + \alpha_2 x_t + u_{2t} \tag{7}$$

The test for a unit root in the u_{1t} sequence becomes equivalent to the test for a unit root in the u_{2t} sequence as the sample size grows substantially large. However, this result which is derived on large sample properties may not be valid on small sample sizes. When this is put into practice, one regression can indicate that the variables are cointegrated but if the order is reversed it indicates no cointegration. This is a major flaw in the procedure since the test for cointegration should be invariant of the choice of the variable selected for normalization. MacDonald and Power (1993) also argued that the use of OLS to estimate a cointegration relationship for an N dimensioned vector does not elucidate whether one is dealing with a unique cointegration vector or simply a complex linear combination of all the distinct cointegration vectors that exist within the system. This technique also fails to capture the underlying time series properties of the data and its test procedures do not have well defined limiting distribution. In addition, the step-wise procedure implies the compounding of errors. Any error introduced in step1 is carried into step 2. Another drawback is that it can estimate only up to one cointegration relationship between the variables. If there are three variables in the system, there could potentially be up to two linearly independent cointegrating relationships. Due to the drawbacks mentioned earlier, the application of Engle-Granger methodology may not give the desired results. Hence the same test for cointegration is performed using Johansson's procedure.

4 The Johansen Multivariate Technique

The Johansen procedure is a multivariate generalization of the Dickey-Fuller test. Nevertheless, this technique does not only offer estimates of all the cointegration vectors existing within a vector of variables, but also it fully depicts the underlying time series properties of the data, and provides a test statistic for the number of cointegrating vectors with an exact limiting distribution. Considering the n variable case in (1-8)

$$x_t = A_1 x_{t-1} + \epsilon_t \tag{8}$$

so that

$$\Delta x_t = \pi x_{t-1} + \epsilon_t \tag{9}$$

where x_t and ϵ_t are (nx1) vectors and A1 an (nxn) matrix of parameters; I an (nxn) identity matrix and π is defined to be (At-I).

The rank of (A1-I) is equivalent to the number of cointegrating vectors. If (A1-I) comprises of all zeros, so that rank $\pi = 0$, all the Δx_{it} sequences are unit root processes. As there is no linear combination of the x_{it} processes that is stationary, the variables are not cointegrated.

The multivariate model can also be generalized to offer a higher-order auto regressive process. Considering (1-10)

$$x_t = A_1 x_{t-1} + A_2 X_{t-2} + ... + \epsilon_t \tag{10}$$

where , x_t is the (nx1) vector $(x_{1t}, x_{2t}, ..., x_{nt})$; and ϵ_t an independently and identically distributed n-dimensional vector with zero mean and variance matrix Σ_ϵ.

Subtracting x_{t-1} from each side to get (1-11)

$$\Delta x_t = (A_1 - I)x_{t-1} + A_2 x_{t-2} + ... + A_p x_{t-p} + \epsilon_t \tag{11}$$

Now add and subtract (A1-I) x_{t-2} followed by (A2+A1-I) x_{t-3} and so on to get (1-12)

$$\Delta x_t = \sum_{i=1}^{p-1} \pi_i \Delta x_{t-1} + \pi x_{t-p} + \epsilon_t \tag{12}$$

where

$$\pi_i = -\sum_{j=i+1}^{p} A_j \tag{13}$$

and

$$\pi = \sum_{i=1}^{p} A_i - I \tag{14}$$

Finding the number of distinct cointegrating vectors can be obtained by checking the significance of the characteristic roots of π. Suppose that the n characteristic roots of matrix π are ordered such that $\lambda_1 > \lambda_2 > ... > \lambda_n$. If the variables in x_t are not cointegrated, then rank π =0 and all these characteristic roots will equal zero. If the variables are not cointegrated, each of the expressions $ln(1 - \lambda_i)$ will be zero.

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} ln(1 - \lambda_i) \tag{15}$$

and

$$\lambda_{max}(r, r+1) = -T ln(1 - \lambda_{r+1}) \tag{16}$$

where, $\lambda_i, i = 1, 2, ..., n$ are the eigenvalues obtained from the estimated π matrix, and T is the number of usable observations. The null hypothesis that the number of distinct cointegrating vectors is less than or equal to r (the number of cointegration relationships) against the alternative hypothesis of more than r cointegrating relationships is tested by the λ_{trace} statistic. The further the estimated eigenvalues are from zero, the larger the λ_{trace} statistic. The λ_{max} tests the null hypothesis that the number of cointegrating vectors is r against the alternative of r+1 cointegrating vectors. If the estimated eigenvalue is close to zero, λ_{max} will be small.

5 Granger Causality for Causal Relationship Methodology

The Granger causality test is a tool popularly used to test the possibility of any temporal statistical relationship with a predictive value between two time series (Granger, 1969). It shows the existence of any possible short-run predictive interrelationships among the stock prices.

Granger starts from the proposition that the present and the past cannot be caused by the future. For instance, if event A occurs post to event B, then A cannot cause B also if A occurs before B, it doesn't necessarily indicates that A causes B (Maddala, 2001). It is essential to realize that the statement "X Granger causes Y" does not mean that Y is the effect or the result of X. Granger causality measures precedence and information content but does not by itself show causality in the common-sense use of the term. Hence, "causality" is defined in terms of predictability, thus variable X causes variable Y if present Y can be better predicted by using past values of X(lagged) than by not doing so, with respect to a given information set that includes X and Y.

Considering two time series Y_t and X_t , the series X_t fails to Granger cause Y_t if in a regression of Y_t on lagged Y's and lagged X's , the coefficient on the latter are zero. Considering (1-17) and (1-18):

$$Y_t = \alpha + \sum_{i}^{k} \beta_i Y_{t-i} + \sum_{i}^{k} \gamma_i X_{t-i} + \epsilon 1_t \tag{17}$$

$$X_t = c + \sum_{i}^{k} \delta_i X_{t-i} + \sum_{i}^{k} \xi_i Y_{t-i} + \epsilon 2_t \tag{18}$$

There are four distinct patterns of causality:

a. unidirectional causality from X to Y; if $\gamma_i = 0, i = 1, 2, ..., k$, and $\xi_i = 0, i = 1, 2, ..., k$, then X_t Granger cause Y_t;

b. unidirectional causality from Y to X; if $\gamma_i = 0, i = 1, 2, ..., k$, and $\xi_i \neq 0, i = 1, 2, ..., k$, then Y_t Granger causes X_t;

c. feedback or bi-directional causality; if γ_i and $|xi_i$ are different from zero , then there is a bi-directional causality in the sense that X_t Granger cause Y_t and Y_t Granger cause X_t ; and

d. no causality; if X_t fails to Granger cause Y_t ($\gamma_i = 0, i = 1, 2, ..., k$)and Y_t fails to Granger cause X_t ($\xi_i = 0, i = 1, 2, ..., k$) concluding that the two series are temporally unrelated.

As the efficient market hypothesis suggests that asset prices are not predictable, the efficient market hypothesis will hold in the case of no significant Granger causality between price series, since the prices cannot be predicted. Having Granger causality between two price series in one direction, violets the efficient market hypothesis as one price series can be predicted by another. Ultimately, bi-directional causality would donate market efficiency as there is no evident prediction relationship. This causality type suggests that proceeds at some point in time, but then at some other point in time proceeds. There is a reaction between the two series but not an evident relationship relating to predictability (Mookerjee, 1987). Some shortcomings were identified in this test. One of them is the arbitrary specification of the lag length (which has an effect on the F statistic, for instance). The lag length choice is suggested to be in agreement with the data time interval to prevent any problems of autocorrelation caused by misspecified dynamics or seasonal effects.

Another criticism is that the test fails to use all the information included in the data as the custom is to use stationarity data (Maddala, 2001). In other words, to achieve stationarity the Granger casuality test has to be implemented on differenced data (returns in this study) - but differencing separates out valuable low frequency information in the data which influences the long run inferences about any probable predictive relationships between different stocks. To address this problem, the concept of cointegration was introduced. the cointegration technique does not require differencing and cointegration theory affirms that the Granger causality runs in at least one direction when two variables are cointegrated. Therefore, in an efficient market price, different stocks cannot be cointegrated (Hall and Henry, 1986).

6 Data and Sample

Jordan market efficiency is tested by applying the cointegration methodology, from a domestic perspective based on the use of five prices indices, and from a national perspective, based on the use of price indices of different countries. This section provides an analysis of the cointegration equations among the five prices indices for the Jordan market and proves the existence of such cointegration relations. This signifies a clear violation of market efficiency as it suggests that information in past prices could have been applied to improve the forecasts of the current prices.

The Engle-Granger two-step method and the Johansen test are used in this study to test for cointegration.,To examine any overall cointegration relationship, all the indices from 1-1-2008 to 31-12-2014 are used together and pair-wise cointegration between each pair of indices is performed.

7 Pair-Wise Cointegration

7.1 The Engle-Granger Two-Step Method

The Engle-Granger two-step method is applied, before using the Johansen method, for comparative purposes and as a preliminary test for cointegration.

The regressions (1.3), (1.4) and (1.5) for each pair of indices are predicted and Table (1-1) displays some simple bivariate cointegration results for the five price indices of the Jordan market. Depending on DF and ADF statistics, the tests show one possible cointegration equation between banks and services indices based on the 10% significance level. Since the existence of a long run relationship between most of the indices has not been found, the stock market does not seem to be efficient for the most of the sample. The Engle-Granger two-step test implies no long run structural relationship for each pairs of price indices since the linear combination of each pairs has stochastic trend and is not stationary.

Table 1: Granger Cointegration Test for each Pair of the Jordan Indices

General = 89.1 + 0.27 Banks				General = 154.1 + 0.18 Insurance			
t-statistic	-96.33	-60.04		t-statistic	-37.43	-7.22	
DW	0.002					DW	0.002
DF	1.657					DF	2.249
ADF	1.805					ADF	2.226
General = 140.8 + 0.017 Industry				General = 151.6 - 0.072 Service			
t-statistic	-81.7	-1.18		t-statistic	-151.62	(-3.56)	
DW	0.002					DW	0.003
DF	2.495					DF	2.453
ADF	2.432					ADF	2.537
Banks = 296 0.86 Insurance				Banks = 305.6 1.07 Industry			
t-statistic	-35.15	(-13.5)		t-statistic	-80.56	(-33.06)	
DW	0.001					DW	0.002
DF	2.186					DF	2.453
ADF	2.028					ADF	2.428
Banks = 366.8 1.51 Service			Insurance = 797+ .38 Industry				
t-statistic	-67.26	(-34.01)	t-statistic	-75.24	-42.28		
DW	0.003					DW	0.004
DF	2.932*					DF	1.385
ADF	2.912*					ADF	1.693
Insurance = 49.3 + 0.61 Service				Insurance = 49.3 + 0.61 Service			
t-statistic	-37.62	-57.28		t-statistic	(-19.85)	-86.74	
DW	0.009					DW	0.007
DF	1.832					DF	2.014
ADF	2.434					ADF	2.224

DW, DF, and ADF denote respectively, Durbin Watson, Dickey Fuller and Augmented Dickey Fuller statistics on the residuals generated from the cointegrating equation. The critical values for these statistics as mentioned in Table II, Engle and Granger (1987), are as follows:

Significance Levels

	1%	5%	10%
DW	0.511	0.386	0.322
DF	4.070	3.370	3.030
ADF	3.770	3.170	2.840

If the values of DW, DF, and ADF from the regression are exceeding the critical values, the null hypothesis of no cointegration is rejected.

7.2 Johansen Approach

To test the cointegration between the Jordan indices, the Johansen approach is used t, while the Johansen multivariate approach is employed to test cointegration using all the price indices.

Table 2 displays comparable results to the ones found through the Engle-Granger two-step method excluding the cointegration between the general and service indices. The test suggests two cointegration equations at the 5% significance level. In accordance with this result, none of the series is actually integrated in the view of the fact that the cointegrating rank equals the number of endogenous variables. The following section shows how the multivariate Johanson approach is implemented to examine any cointegration equation. This approach is used twice: first by using all indices together and second by using all indices aside from the service index which is potentially I(0).

Table 2: Johansen Cointegration Test for each Pair of Jordan Indices

Johansen Cointegration Test					
	Eigenvalue	Likelihood Ratio	5%	1%	Hypothesized
General Banks	0.006198	18.05547	21.40806	25.74548	None
	0.00149	3.490941	10.35738	13.74783	At most 1
General Insurance	0.004284	13.10244	21.40806	25.74548	None
	0.001301	3.049244	10.35738	13.74783	At most 1
General Industry	0.006271	18.41542	21.40806	25.74548	None
	0.001561	3.662182	10.35738	13.74783	At most 1
General Service	0.00564	17.23049	13.02916	16.94382	None **
	0.0017	3.984882	3.17908	5.622575	At most 1 *
Bank Insurance	0.003585	10.77059	13.02916	16.94382	None
	0.001007	2.360044	3.17908	5.622575	At most 1
Bank Industry	0.006623	19.29754	21.40806	25.74548	None
	0.001592	3.729665	10.35738	13.74783	At most 1
Bank Service	0.006202	16.40161	13.02916	16.94382	None *
	0.000781	1.828253	3.17908	5.622575	At most 1
Insurance Industry	0.001781	4.238313	13.02916	16.94382	None
	2.83E-05	0.066335	3.17908	5.622575	At most 1
Insurance Service	0.004058	12.31935	13.7149	17.8356	None
	0.001194	2.79858	3.3464	5.9185	At most 1
Industry Service	0.003855	11.70338	13.02916	16.94382	None
	0.001135	2.658651	3.17908	5.622575	At most 1

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

L.R. rejects any cointegration at 5% significance level

The Table presents the trace test, using Eviews software to determine the number of cointegration relations. The eigenvalues are presented in the first column, while the second column (Likelihood Ratio) presents the LR test statistic (trace statistic):

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} ln(1-\lambda_i) \tag{19}$$

for $r = 0, 1, .., n-1$ (in this Table $n = 2$ as tow series are used to perform the test) where i is the i-th largest eigenvalue. To determine the number of cointegrating relations r, we can proceed sequentially from $r = 0$ to $r = n-1$ until we fail to reject the null hypothesis of cointegration. The first row in the Table tests the hypothesis of no cointegration, the second row tests the hypothesis of one cointegration relation, the third row tests the hypothesis of two cointegrating relations, and so on, all against the alternative hypothesis of full rank, i. e. all series in the VAR are stationary.

7.3 Group Cointegration Johansen Approach

The results exhibited in Table 1-3 indicate that there is one cointegration equation at the 5% significance level when all indices are used, but the hypothesis of cointegration is rejected at the 5% significance level when the service index is excluded and the other four indices are applied. This result reinforces the previous results and implies no long run relationship between indices in the Jordan financial market. In general, these findings oppose the previous findings which proposed that the Jordan market is not weak form efficient. converserly, some studies were not persuaded to use the cointegration method to test market efficiency.

Table 3: Johansen Cointegration Test for All Jordan Indices

	Eigenvalue	Likelihood	5%	1%	Hypothesized
General Banks Insurance Industry Service	0.014777	65.90194	57.93366	64.31719	None **
	0.006898	31.00396	39.91606	46.04593	At most 1
	0.004438	14.79136	25.09444	30.14208	At most 2
	0.001577	4.375503	13.02916	16.94382	At most 3
	0.000291	0.680661	3.17908	5.622575	At most 4
General Banks Insurance Industry	0.008601	31.81239	39.91606	46.04593	None
	0.003191	11.57459	25.09444	30.14208	At most 1
	0.001425	4.089677	13.02916	16.94382	At most 2
	0.000321	0.751606	3.17908	5.622575	At most 3

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. rejects any cointegration at 5% significance level.

8 Granger Causality Test

Granger causality tests are applied to analyze the short run dynamics of the series and to investigate causality between each pair and its direction. Since the inferences based on the standard regression do not hold when the regressors are non-stationary, the indices returns are used instead of levels. Table 4 reviews the results of testing the null hypothesis and proves that the first index series does not Granger cause the second. The results are remarkable, all indices have a short run relationship with the each other, and some pairs have the relationship in both directions while others in one direction.

Because six of the pairs have a relationship in both directions, the results imply that stock prices are highly predicted which goes against the EMH. However, it is worth mentioning that some studies have reservations about the cointegration and Granger causality as tests for EMH. Granger (1992) claims that price changes would be consistently predictable, and a money machine could be created if the cointegration relations and causality exist among the financial data. Granger based his claim on the logic that cointegration is a causal relationship which contains at least one exogenous variable and so cointegration would certainly entail predictability. Stock and Watson (2003) concluded, after investigating the empirical evidence of the forecasting ability of asset prices, that some asset prices are predictable in some countries in some periods. Which series predicts what, when and where, is however, hard to predict. Most empirical evidences, as reviewed in Stock and Watson (2003), indicate that a significant Granger causality statistic does not hold significant information on whether the indicator has been reliable in predicting current and future prices or not. Consequently, the predictability concluded from cointegration and causality tests does not necessarily mean creating a money machine or violating market efficiency.

Table 4: Pairwise Granger Causality Test for Jordan Return Indices

Null Hypothesis:	Obs	F-Statistic	Probability
RBANKS - RGENERAL	1870	1.973593	0.07645456*
RGENERAL - RBANKS		4.743905	0.0027234***
RINDUSTRY - RGENERAL	1870	2.429829	0.0441084*
RGENERAL - RINDUSTRY		4.664222	0.00299663***
RINSURANCE - RGENERAL	1870	0.41616	
RGENERAL - RINSURANCE		3.661621	0.01000716**
RSERVICES - RGENERAL	1870	3.730063	0.00921239**
RGENERAL - RSERVICES		4.080702	0.00604221***
RINDUSTRY - RBANKS	1870	5.324388	0.00135725***
RBANKS - RINDUSTRY		4.54	0.00347634***
RINSURANCE - RBANKS	1870	0.913053	
RBANKS - RINSURANCE		3.059718	0.02065156**
RSERVICES - RBANKS	1870	3.198688	0.01747248**
RBANKS - RSERVICES		3.659104	0.01004009**
RINSURANCE - RINDUSTRY	1870	0.813198	
RINDUSTRY - RINSURANCE		2.946206	0.02368023**
RSERVICES - RINDUSTRY	1870	6.229353	0.00045568***
RINDUSTRY - RSERVICES		2.245086	0.061919*
RSERVICES - RINSURANCE	1870	1.182527	0.198507
RINSURANCE - RSERVICES		3.594436	0.010851

*** Significant at 1% level ** Significant at 5% level * Significant at 10% level

9 Conclusion

To examine financial integration and the co-movement of stock prices, the cointegration tests are put into use in this paper. The finding of the existence of such cointegration relations is perceived as a clear violation of market efficiency as it implies the possibility of using information in past prices to forecast the current and future prices.

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