Examining Causal Relationship between Saudi Stock Market (TASI) and US Stock Markets Indices

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Authors’ contributions

This work was carried out in collaboration among all authors. Author SM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MA and BA managed the analyses of the study. All authors read and approved the final manuscript.

ABSTRACT

This study examines whether there is a causal relationship between Saudi stock market and US stock markets indices, Saudi Arabia is America's leading trading partner in the world, The most commonly used indices US are Dow Jones Industrial Average and S&P 500, the stated indices are taken for study. There are several methods have been used to examine the existence of relationship. However, the Johansen approach to integration is considered a more reliable method than other conventional integration approaches, Johansen approach is more robust and performs well for large sample size, the results show that the null hypothesis of no relationship cannot be accepted. This suggests the existence of a long-run relationship between SAUDI and US Stock markets.

Keywords: Stock market integration; cointegration test; causality test; TASI; US stock markets indices.

1. INTRODUCTION

Over the past few decades, the concept of linkage among equity markets around the world has gained wide currency. As portfolio theory postulate that gains from diversification sans risk depends on low correlation among securities, it is pertinent to gauge the securities markets dependence to fortify the portfolio performance by locating less correlated markets. Escalated international trade, technological innovations and financial market liberalization are the cardinal ingredients in accelerating the pace of investment inflows and outflows at international echelon of business and thereby providing fillip to syncing of national equity markets. This association among economies contributes to rising homogeneity in market performance in reactions to international financial effects. The integration of financial markets hinges on dexterity of international investors to drive in the other market securities. Further the process of

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integration gets propelled by the expectations and information outlook of investors in employing fund in overseas stock investment. Accordingly, the dynamics of integration among the equity markets bring to for the attention of erudite investors and academic pundits on the multifarious facets of international investment decisions and policy implications [1].

Global reports cogently corroborate Saudi Arabia as the largest economy in the Middle East and North Africa (MENA) region and the 13th most economically competitive country in the world. Further the Kingdom is member of G20, OPEC and of the WTO. The Kingdom is ranked eighth among the world’s ten high growth economies by the International Monetary Fund (IMF) [1].

The Saudi stock market is the older in the region; the stock market itself did not begin to emerge until the late 1970s. The saga of international investment inflow in the kingdom started on account of accelerated economic reforms during the 1990s that unfolded the pace of privatization and liberalization on the Saudi capital market. Further, in 2001, the commencement of Tadawul accelerated the trading volume in Saudi stock and correspondingly led to establishment of new official Saudi stock market index christened as TASI (Tadawul All Share Index). From 2003 onwards, an all integrated endeavor has been formed to enhance the regulatory capability of Capital Market Authority (CMA); the regulator of Saudi Stock market in order to enhance the level of transparency in market.

The number of companies listed on the exchange increased from 163 by 2013 to 175 at the end of 2016, with total market capitalization of US$ 450.21 billion.

The purpose of this paper is to test the existence relationship between Saudi stock market and US stock markets indices (Dow Jones, S&P500). Where there are strong economic and financial linkages between the two countries.

2. LITERATURE REVIEW

The literature review develops a theoretical background for the study through a review of relevant theories. The literature review places the study in context by reviewing prior stock market integration studies in both global and regional contexts. Although there has been extensive research on equity market integration, there is no agreement on this phenomenon. Research results differ according to the methodology used, the model, the data, the sample; and the time period. Some studies have concluded that world equity markets are integrated, that the US market is the most influential stock market in the world, and that the Japanese market is the second most influential. On the other hand, some studies have reported no lead or lag relationships among international markets at all.

Grubel [2] was the first to explore the risk-return relationships of internationally diversified portfolios by employing the models of portfolio balance developed by Tobin (1958) and Markowitz (1959). He studied the effect of international diversification of asset holding on international economic relations by using data on the share price indices of 11 industrialized countries from 1959 to 1966. Results indicated that diversification among 11 countries has allowed investors a superior return-risk trade-off compared to a portfolio consisting of Moody’s Industrial Average of common Stock.


Stulz [4] defined the integration of financial markets as “if assets with perfectly correlated returns have the same price, regardless of the location in which the trade”. A fully integrated financial market is defined as a situation where investors earn the same risk adjusted expected return on similar financial instruments in different public markets, Philippe and Schwartz [5] which means the lack of arbitrage profit achievement. In other words, if the risk of an identical financial instrument is traded on the same price in different markets, then it will be an indication of integration between these markets. However, a financial market is considered to be more integrated, if there are stronger domestic returns depend on shocks of world market, which means that the internal market is interacting with the world market. This definition underlines not only the openness of financial markets but also measures directly the extent to which shocks are transferred across financial markets. The transfer of a shock requires both the removal of barriers and the capital flows across markets in order to
take advantage of market opportunities, Fratzscher [6]. It is believed that, in case of a more fully integrated financial market, the country’s economy and the subject market will not be separated from any external influence.

Choudhry et al. [7] and Masih and Mansur [8] mentioned that financial markets development improves the degree of integration among these markets. Moreover, financial integration among markets has gained considerable attention of both the finance specialists and policy markets.

To summarize, we will refer to Von Furstenberg and Jeon [9] conclusions. The previous studies say that, if two securities have identical cash flows, they should have the same price. In other words, all assets with similar identifications and same risk characteristics should generate the same return in the different markets ignoring the location or any other factors.

Portfolio diversification and management are considered as important implications of the existence of a long run relationship between financial markets. Kearny and Lucey [10] mentioned that when there is no integration, investors may try to reduce the risk through diversifying their portfolio among financial markets. Therefore, there is a contrary relationship between the benefits generated out of diversifying the portfolio and the level of financial markets integration [11].

There are two common methods to measure or examine the financial markets integration: The first method is the ICAPM or the international capital asset pricing model, and the second method is through using the approaches of cointegration [11].

The ICAPM assumes that the financial markets are integrated. ICAPM comes opposite to the CAPM which assumes that financial markets are segmented. Moreover, the ICAPM assumes that financial markets are integrated when two securities with same risk characteristics in tow different markets have the same price levels. Several studies were conducted using the ICAPM as a measurement of integration such as Solink [12], Stutz [4], Alder and Dumas, Philippe and Schwartz [5,13] Buckerberg [14] in his study used the data of twenty emerging financial markets for the period between 1977 and 1991 on a monthly basis. The results of the previous study indicated that eighteen countries out of the twenty are integrated mainly due to the cash flow coming from the industrial countries during 1980’s.

The most popular methods used to test the extent of integration between financial markets are the cointegration approaches.

Azman and other researchers [15] mentioned that, one of the stock prices habits is that over a long period the stock prices tend to move together and follow a common upward trend. In other words, common trends are expected to be achieved out of these indices if financial markets are integrated. This means that, the co-movements between securities prices represent an indication for the existence of integration. Moreover this co-movement or common trend implies that one market will help in predicting the returns of the other, due to the existence of a valid error correction representation.

Kasa [16] was one of the earliest researchers to measure the existence of financial integration using cointegration approach. In his research, Kasa finds that five (list them) industrial countries are correlated perfectly. These countries are USA, Canada, Germany, England and Japan.

The cointegration approach of Johansen-Juselius [17] was used by Darrat [18] The previous study was explored to examine the integration between Morocco, Jordan and Egypt and to what extent they are linked among themselves and with the international financial markets. The research concluded that most Middle East and North Africa (MENA) countries are segmented internationally and integrated regionally. The financial markets integration in the MENA region was examined also by Neaime [19] using the Engle-Granger efficient maximum likelihood test to examine the existence of the long-term relationship among the MENA markets themselves and between the MENA markets and the world markets represented by the US, UK and French markets. The study indicated a solid integration between MENA countries and developed markets and a weak integration among MENA markets. A research conducted by Marashdeh [20] to examine the extent of financial integration in the MENA region, using the ARDL approach. Marashdeh adopted the ARDL approach to examine the long-run equilibrium relationship among stock price indices in the MENA region stock markets. Long run equilibrium relationships were found in MENA region markets. The empirical findings of this study indicated that the stock markets in the
MENA region are found to be integrated with each other.

Febrian, E and Herwany, A. and Yang J, Kolar, W and Insik, M [21,22] use different cointegration approaches to measure financial market integration among several markets in Asia. Different results were reported regarding the integration of these financial markets.

There are not many of research studies conducted to examine the extent of integration among Gulf Corporation Council (GCC) financial markets. Abrahm A, Seyyed F and Al [23] applied the examination on Kuwait, Saudi Arabia and Bahrain and reached a low correlation between these three financial markets. A long-term equilibrium relationship between three GCC markets founded by Hassan (2003) namely, Bahrain, Kuwait and Oman. Johansen-Juselius [17] method used by Al-khazali O, Darrat A, and Mohsen S [24] to examine the intra regional integration of the GCC stock markets, namely, Kuwait, Bahrain, Saudi Arabia, and Oman. The research finds a common stochastic trend over the long run among these countries. Other research conducted by Alkulaib Y, Najad,M and Mashayekh [25] argues that the GCC region has more interaction and linkage than the MENA region due to the similar economic nature of these countries.

3. METHODOLOGY

3.1 Granger Causality Tests Effect

Several studies have been devoted to the study of causality between variables Granger [26]. Furthermore, we carried out the Granger causality test where Granger [26] proposed a time series data based approach in order to determine causality. For example if we want to explore the causal relationship between oil prices \( (p_i) \) and US exchange rate against the euro \( (y_i) \)

\[
p_i = \sum_{i=1}^{n} a_i p_{i-1} + \sum_{i=1}^{n} \beta_i y_{i-1} + \varepsilon_i
\]

\[
y_i = \sum_{i=1}^{n} \lambda_i p_{i-1} + \sum_{i=1}^{n} \delta_i y_{i-1} + \varepsilon_i
\]

With \( n \) the number of lags

If \( \beta \) coefficients are jointly significantly different from zero, the Granger test suggests that oil prices \( (p_i) \) is a cause of US exchange rate against the euro \( (t_{c_e}) \) if \( \lambda_i \) is jointly significantly different from zero, the Granger test suggests that US exchange rate against the euro \( (t_{c_e}) \) is a cause of oil prices \( (p_i) \).

If the two causalities are verified, we can conclude the return causality "feedback causality" between the two variables.

3.2 Causality Test and Cointegration Variable

The relationship causality between different time series is based as following steps:

3.2.1 Unit root tests

The vector error correction model results to lead us to examine the stationary of the series. A stochastic process is stationary if its first and second moments are constant.

Analytically, \( y_i \) is stationary if:

\[
E(y_i) = \mu \quad \forall t \\
E[(y_i - \mu)(y_{i-h} - \mu)] = \Gamma_y(h) = \Gamma_y(-h)^t
\]

With \( \Gamma_y(h) \) is a finite covariance matrix.

Dickey-Fuller (DF) tests is that the non-stationary statistical series. In other words, this test detects the presence or absence of a unit root.

Base models of the construction of this test are:

\[
\Delta y_t = (\phi_1 - 1)y_{t-1} + \varepsilon_t \\
\Delta \bar{y}_t = (\phi_1 - 1)y_{t-1} + \\bar{\beta} + \varepsilon_t \\
\Delta \bar{y}_t = (\phi_1 - 1)y_{t-1} + \bar{\beta} + \bar{\delta}t + \varepsilon_t
\]

By using the statistical Student’s

\[
t = \frac{\hat{\theta}_1 - 1}{\sigma_{\hat{\theta}_1}}
\]

unit root testing:

\[
\{H_0: |\phi_1| = 1 \\
\{H_1: |\phi_1| < 1
\]

To get a broader view, Dickey-Fuller took an autoregressive process of higher order known as the Augmented Dickey-Fuller (ADF). This test is represented as a following:

\[
\Delta y_t = (\phi_1 - 1)y_{t-1} + \sum_{i=1}^n \theta_i \Delta y_{t-i} + \varepsilon_t
\]
\[ \Delta y_t = (\phi_1 - 1)y_{t-1} + \sum_{i=1}^{p} \theta_i \Delta y_{t-i} + \beta + \varepsilon_i \]
\[ \Delta y_t = (\phi_1 - 1)y_{t-1} + \sum_{i=1}^{p} \theta_i \Delta y_{t-i} + \beta + \theta t + \varepsilon_i \]

3.2.2 Cointegration

The main objective of this paper is to assess not only the pairwise nature of causality among the variables, but also the short run and long run dynamic impact as well, we tested for cointegration using two well known approaches: the one developed by Engle and Granger [27] and the other one by Johansen [28].

3.2.2.1 Engel - Granger method

The Engle–Granger test is a procedure that involves an OLS estimation of a pre-specified cointegrating regression between the variables. This was followed by a unit root test performed on the regression residuals previously identified. We applied the Engle-Granger two-step procedure:

- **Step 1**: Static regression between integrated variables.
- **Step 2**: Test to verify the residual stationary.

This procedure has some weaknesses, as the test is sensitive to which variable is used as a conditioning left-hand-side variable, which is problematic in the case of more than two variables.

3.2.2.2 Johansen method

Johansen developed the maximum likelihood estimator for cointegration analysis. Johansen’s cointegration test is used as a starting point in the vector autoregression (VAR) model. The vector autoregression model of order \( p \) (VAR \( (p) \)) is constructed as a following equation:

\[ \Delta y_t = \prod_{i=1}^{r} y_{t-i} + \sum_{i=1}^{r} \Gamma_i \Delta y_{t-i} + c + \varepsilon_i \]

The number of cointegrating relationship of the system is based on determining the rank of the matrix \( \Pi \). Three cases are distinguished:

- If \( \text{rank} \Pi = 0 \), then the matrix \( \Pi \) is null and the VAR model to writing as a VAR in difference.
- If \( \text{rank} \Pi = n \), then the matrix \( \Pi \) is full rank and \( y_t \) is stationary.

The number of cointegrating relationship is determined by through a sequential procedure. The decision rule is as a following:

- If \( 0 < \text{rank} \Pi = r < n \), then there are \( r \) cointegrating relationship between the process which consists \( Y_t \).

The Likelihood ratio is the ratio that gives the LR statistic defined as follows:

\[ LR = -T \sum_{i=r+1}^{K} \log(1 - \lambda_i) \quad \text{for} \quad r \]

\[ = 0.1, \ldots, \ldots, K - 1 \]

With \( T \) : The number of observations
\( \lambda_i \) : The eigenvalue of the matrix \( \Pi \)
\( K \) : number of variables
\( r \) : rank of matrix \( \Pi \)

3.3 An Error Correction Model

For interpret the vector error correction model found in the different regression equations. Indeed, an error correction model (ECM) can detect the dynamics of short-term and long term of a variable around its stationary equilibrium value. Thus, for an adjustment error correction requires that the sign of the coefficient of the residual is negative and statistically significant. In this regard, the higher the absolute value of the coefficient is higher, faster we reach the long-run equilibrium.

The model error correction reads:

\[ \Delta y_t = \alpha_1 z_{t-1} + \text{Lagged}(\Delta y_t, \Delta y_t) + \varepsilon_{1t} \]
\[ \Delta y_t = \alpha_2 z_{t-1} + \text{Lagged}(\Delta y_t, \Delta y_t) + \varepsilon_{2t} \]

With \( z_t \) the error correction term to resulting from estimating the cointegrating relationship, \( \varepsilon \) is the error term stationary

\[ |\alpha_1| + |\alpha_2| \neq 0 \].
3.4 Causality Test

The causality test based on the model vector error correction has the advantage of providing a causal relationship even if no estimated coefficient of lagged variables used is significant. Thus, an error correction model after processing can be rewritten as following equations:

\[
\Delta p_t = \alpha + \sum_{i=1}^{K} \lambda_i \Delta p_{t-i} + \sum_{i=1}^{K} \delta_i \Delta y_{t-i} + \theta Z_{t-i} + \varepsilon_t
\]

\[
\Delta y_t = \beta + \sum_{i=1}^{K} \phi_i \Delta y_{t-i} + \sum_{i=1}^{K} \psi_i \Delta p_{t-i} + \mu_t
\]

From these both equations, p_t does not cause y_t in the sense of Granger if \( \phi_i=\psi=0 \). y_t does not cause p_t if \( \delta_i=\theta=0 \).

Cointegration cannot be rejected.

4. DATA AND DESCRIPTIVE STATISTICS

January 2007 to January 2017. These indices are for two markets, namely, SAUDI and USA market, there are 121 observations for each.

- **Objectives of the study**: The objective of the study is to Examining causal relationship between Saudi stock market (TASI) and US stock markets indices (S&P500, DOW JONES)

- **Period of study**: This study uses the monthly stock price indices for a period ranging from 1/1/2007 to 1/1/2017. Sources of Data: The Arab Monetary Fund, department of capital markets, has provided the data used in the study.

- **Rationale for the selecting Stock Market Indices**:

  The following section gives summary of chosen indices:

  - **TASI**: The Tadawul All Share Index (TASI) is the stock market index which manifests the performance of all companies listed on the Saudi stock Exchange.

  - **US Indices**: Saudi Arabia is America’s leading trading partner in the world, The most commonly used indices in US are Dow Jones Industrial Average, S&P500. Accordingly

The stated indices are taken for study.

The descriptive statistics of stock indices are presented in Table 2. Both the table cover the summary statistics, namely sample means, minimums, maximum, medians, standard deviation (SD), skwness, kurtosis, SP and DJ registered highest mean during the period, while DJ has registered highest standard deviation and TASI has registered highest skewness and kurtosis during the period.

<table>
<thead>
<tr>
<th>S.N</th>
<th>Index selected for the study</th>
<th>Symbole</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TASI</td>
<td>TASI</td>
<td>Saudi</td>
</tr>
<tr>
<td>2</td>
<td>S&amp;P500</td>
<td>SP</td>
<td>USA</td>
</tr>
<tr>
<td>3</td>
<td>Dow Jones Industrial Average</td>
<td>DJ</td>
<td>USA</td>
</tr>
</tbody>
</table>
Table 2. Group descriptive statistics for the sample markets

<table>
<thead>
<tr>
<th></th>
<th>TASI</th>
<th>SP</th>
<th>DJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>7369.541</td>
<td>1525.701</td>
<td>13700.38</td>
</tr>
<tr>
<td>Median</td>
<td>7041.200</td>
<td>1426.190</td>
<td>13104.14</td>
</tr>
<tr>
<td>Maximum</td>
<td>11176.00</td>
<td>2278.870</td>
<td>19864.09</td>
</tr>
<tr>
<td>Minimum</td>
<td>4384.600</td>
<td>735.0900</td>
<td>7062.930</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>1465.655</td>
<td>400.7613</td>
<td>3102.094</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.576432</td>
<td>0.178370</td>
<td>0.035171</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.740821</td>
<td>1.906088</td>
<td>2.039320</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>7.039521</td>
<td>6.674700</td>
<td>4.677927</td>
</tr>
<tr>
<td>Probability</td>
<td>0.029607</td>
<td>0.035531</td>
<td>0.096428</td>
</tr>
<tr>
<td>Sum</td>
<td>891714.5</td>
<td>184609.8</td>
<td>1657746.</td>
</tr>
<tr>
<td>Sum Sq. Dev.</td>
<td>2.58E+08</td>
<td>19273155</td>
<td>1.15E+09</td>
</tr>
<tr>
<td>Observations</td>
<td>121</td>
<td>121</td>
<td>121</td>
</tr>
</tbody>
</table>

5. RESULTS AND DISCUSSION

5.1 Unit Root Tests

Table 3 (test of serie TASI), Table 4 (test of serie S&P500) and Table 5 (test of serie DOW GONES) represents the results of unit root tests. The results show that all the series are non stationary at level. Taking the variables in their first difference, results show that all series are integrated of the same order.

Table 3. Test of serie TASI

Null Hypothesis: D(TASI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=12)

<table>
<thead>
<tr>
<th></th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-10.32735</td>
<td>0.0000</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.486064</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.885863</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.579818</td>
<td></td>
</tr>
</tbody>
</table>


Table 4. Test of serie S&P500

Null Hypothesis: D(SP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=12)

<table>
<thead>
<tr>
<th></th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-10.01352</td>
<td>0.0000</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.486064</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.885863</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.579818</td>
<td></td>
</tr>
</tbody>
</table>


Table 5. Test of serie DOW GONES

Null Hypothesis: D(DJ) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=12)

<table>
<thead>
<tr>
<th></th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-10.25456</td>
<td>0.0000</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.486064</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.885863</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.579818</td>
<td></td>
</tr>
</tbody>
</table>

Table 6. The number of cointegrating vectors

<table>
<thead>
<tr>
<th>No. of CE(s)</th>
<th>Hypothesized Trace</th>
<th>Statistic 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.197986</td>
<td>31.86441</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.061175</td>
<td>7.374544</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.003306</td>
<td>0.367560</td>
</tr>
</tbody>
</table>

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 7. Causality test

<table>
<thead>
<tr>
<th>Null Hypothesis:</th>
<th>Obs</th>
<th>F-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP does not Granger Cause TASI</td>
<td>110</td>
<td>1.31482</td>
<td>0.2300</td>
</tr>
<tr>
<td>TASI does not Granger Cause SP</td>
<td></td>
<td>1.61631</td>
<td>0.1081</td>
</tr>
<tr>
<td>DJ does not Granger Cause TASI</td>
<td>110</td>
<td>1.53245</td>
<td>0.1344</td>
</tr>
<tr>
<td>TASI does not Granger Cause DJ</td>
<td></td>
<td>1.93288</td>
<td>0.0457</td>
</tr>
<tr>
<td>DJ does not Granger Cause SP</td>
<td>110</td>
<td>0.46123</td>
<td>0.9220</td>
</tr>
<tr>
<td>SP does not Granger Cause DJ</td>
<td></td>
<td>0.27546</td>
<td>0.9889</td>
</tr>
</tbody>
</table>

5.2 Johansen Cointegration Tests

Table 6 presents the test results for the number of cointegrating vectors. The results show that the trace statistic suggests the presence of one cointegrating equation among the three variables.

5.3 Causality Test

Causality test between TASI, S&P500 and DOW JONES shows the existence of a unidirectional causality emanates from TASI to DOW JONES, Table 7 presents results of pairwise Granger causality among tow markets and three indices.

6. CONCLUSION

We have analyzed the historical trend of Saudi stock market indice (TASI) and Us stock markets indices (DOW JONES & S&P500) and investigated the long-run relationship and linkages of these markets.

The result of this study provides a existence of causality relationship between Saudi stock market (TASI) and US stock markets indices, The application of Johansen cointegration and Granger causality tests made it clear that the direction of causality is from TASI to DOW JONES over 1/1/2007 to 1/1/2017.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES


