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TESTING WEAK-FORM MARKET EFFICIENCY: THE CASE OF SAUDI ARABIA

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ABSTRACT

The study intends to investigate if the stock market in Saudi Arabia follows the weak form of market efficiency using daily data from Tadawul All Share Index (TASI). The daily data was collected from January 2012 to January 2019. The study employed different of tests types such as: autocorrelation, unit root test, runs test, and variance decomposition test that are used to assess the daily data of the Saudi stock market. The results from autocorrelation, unit root test, runs test, and variance decomposition test indicate that the Saudi stock market does not follow the weak form of market efficiency. However, future studies are required to understand variations in the Saudi stock market prices. Additionally, the results recommend conducting further studies to test the semi-strong form of efficient market hypothesis in Saudi Arabia.Moreover, future studies also need to focus on the adoption of correction and regulations by the policymakers in the Saudi stock market.

Contribution/ Originality: This study contributes to the existing literature on emerging stock markets in general and particularly to the Saudi market since the majority of the studies are done in developed countries with well-organized stock markets. Also, it includes a new period where new regulations were adopted by the Saudi stock market.

1. INTRODUCTION

In the contemporary business world, the 2030 vision of Saudi Arabia is notorious among the investors seeking opportunities to become part of one of the biggest global economies (Alhawassi et al., 2018). It is well-established that economic growth and development are indicated by stock market health. This economic growth can be traced from a positive signal in the equity market (Sornette, 2017). The country's stock market history dates to 1934, when trading practices were unofficial until established officially in 1983 (Asiri & Alzeera, 2013). The Saudi stock market is still under development as compared to advanced countries' stock markets; although it holds the 13th position in the list of countries with the strongest economy (Rehman, Hazazi, & Programe, 2014). Few of the previous studies have compared the volume of Saudi economy at its establishment with advanced economy (Rehman, Khan, & Khokhar, 2015; Syed & Bajwa, 2018).

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Various methods are used to assess the regulation and development of market capacity, given the importance of the stock market in the country's economic progress. Efficient market hypothesis (EMH) is one of the ways to examine the development and regulation of stock market, as it explains some of the behavior in the stock market prices. Similarly, Kofarbai and Zubairu (2016) showed some interest in developing countries' markets. Specifically, very little research has been done on testing the EMH in the Saudi stock market. Hokroh (2013) investigated the weak form of efficiency holds before and after formation of Tadawul. However, it failed to prove whether the Saudi stock market follows the weak form of efficiency or not. Similar results regarding the Saudi stock market were found by Onour (2009) and Al Ashikh (2012).

EMH has three forms of market efficiency that distinguish the level of the information used in the market; weak form, semi-strong form, and strong form (Malkiel & Fama, 1970). The present study tested the weak form of efficiency to show how stock prices reflect past prices. According to Fabozzi (1992) investors cannot make any profits because the future prices are a reflection of the past prices and the investors have information about the past prices. In response to this, the Saudi market is sensitive of all the new information that reflect stock market price.

The present study investigated the idea of the weak form of market efficiency in the Saudi stock market index also known as Tadawul All Share Index (TASI) from 1st January 2012 to 9th January 2019. The study used daily data, collected from TASI. The rationale for assessing the market for the weak form of efficiency was based on the ambiguous results provided by previous studies. The study results add value to the existing body of literature that previously has not been thoroughly investigated and failed to provide a clear picture of the Saudi stock market. The present study has contributed to limited literature on emerging stock markets in general as well as the Saudi market, since a majority of the studies are devoted to well-developed countries with well-organized stock markets. The study results also contribute towards future research on the Saudi Stock Exchange through the addition of further insights into the dynamics of this market. Because of the limited number of studies in the Saudi stock market, this study provided a better understanding of the Saudi stock market, since there are varying results as to whether Saudi stock market followed weak form of efficiency or not. It has been investigated in the literature over different periods of time, however there are no common results which indicates that the time covered is actually relevant. In addition, the Capital Market Authority (CMA) recently have implemented many policies to convey the level of the market efficiency. Our study covered the periods where the market was well regulated and had already absorbed most of the corrections made by the CMA.

1.1. History of the Saudi Stock Market

The Saudi stock market was founded in 1935 when the "Arab Automobile Company" made shares available to the public (Saudi Arabian Monetary Agency, 1997). Since then, the Saudi stock market went through different stages and changes in regulations, structures, and operations. As a result, we divided the devolpment of the Saudi stock market into three different phases.

1.2. Phase one: Early Stage (1935 − 1984)

The first phase is when the Arab Automobile Company's shares first went public in 1935 and that marked the starting point of the Saudi Stock Market. By 1984, the number of companies had increased to 50. We can summarize the most important actions in this phase in the following points:

1. The Saudi stock market was informal and unregulated.
2. Only Saudi citizens could trade in the market.
3. The biggest increase in the number of companies were between the years 1976 and 1980.
4. According to Abdeen and Shook (1984) during the first stage the Saudi stock market did not have a legal regulation framework. As an alternative, the Ministry of Finance and National Economy, SAMA, and the Ministry of Commerce were charged to regulate and manage the Saudi stock market.

1.3. Phase two: Establishment Stage (1985 − 2003)

This phase started when the council of ministers, in 1983, established a joint committee consisting of the Ministry of Finance and National Economy, Saudi Arabia Monetary Authority (SAMA), and the Ministry of Commerce, to regulate and manage the Saudi stock market. The Ministry of Commerce had the responsibility of regulating and supervising the primary market offering or IPO and joint-stock companies. SAMA's responsibility was regulation, and supervision of the stock market's daily activity (SAMA, 1997). The Ministry of Finance had the responsibility of overall governance for regulating, developing, and controlling both the Central Saudi Bank and SAMA, which controls the Saudi stock market (Dukheil, 2002).

1.4. Phase three: Modern Stage (2004 − present)

The second stage was associated with several weaknesses that delayed the growth of the Saudi stock market. Saudi officials took several significant actions to improve the Saudi stock market. In July 31, 2003, the Capital Market Law (CML) was established by Royal Decree No. (M/30). The CMA is a government entity that financially and administratively reports directly and independently to the President of the Council of Ministers (Capital Market Authority, 2018). The main tasks of the CMA as listed on their website are to:

1. Develop and control the stock exchange and the capital market, pursue to grow and improve the practices of entities trading in securities, and implement procedures that eliminate any unfair trading.
2. Control and screen the issuance of and dealing in securities. Regulate and monitor business activities of parties subject to the CMA's supervision.
3. Implement polies that protect citizens and investors from any unreliable practices, or acts linking to a fraud, deception, cheating, or manipulation.
4. Seek to achieve fairness, efficiency and transparency in securities transactions.
5. Control proxy and purchase requests and public offers of shares

2. LITERATURE REVIEW

In this section we discuss the previous studies that investigated the weak form of efficiency in the Saudi stock market. We examined the time periods they cover in the previous work, methodology, regime change or new policy, and country studied. Our aim was to examine whether the Saudi stock market follows a weak form of efficiency over a daily period from 01/01/2012 to 1/09/2019.

The weak form of efficiency has been focused on by various prior studies. For instance, Alkhatib and Harasheh (2014) explored the EMH weak-form market efficiency in Palestine and suggested that the stock market PEX is ineffective. This might be because the weak form of efficiency demonstrates the behaviour like autocorrelation and stationery. Similarly, Guermezi and Boussaada (2016) explored the same weak form of efficiency EMH on the Tunisian Stock Market, from July 2012 to June 2013. The study concluded that the country does not follow the weak form of efficiency behaviour, particularly, the banking sector.

Budd (2012) examined the efficient market hypothesis and random walk hypothesis for seventeen sectors of the Saudi Arabian stock market over April 2007 to May 2011. The author used the variance ratio test and runs test to investigate the random walk and efficient market hypothesis. He found none of the seventeen sectors in the Saudi stock market follow the random walk hypothesis under the Variance Ratio. However, the banking, building, insurance, and telecom sectors show evidence of the weak-form efficiency under the runs test.

The stock market of Pacific-Asian countries i.e. Malaysia, Hong Kong, India, Korea, Sri Lanka, China, Philippine, Taiwan, Australia, Singapore, Pakistan, Australia, Indonesia, and Thailand were investigated by Hamid, Suleman, Ali Shah, Akash, and Shahid (2017). The study applied the Q-statistic Test, Unit Root, and Autocorrelation from January 2004 to December 2009. It concluded that the random walk or weak efficiency form was not followed by the monthly prices in all the countries.

Reflecting upon the studies conducted on Saudi Arabia, Asiri and Alzeera (2013) investigated the weak form of efficiency in the Saudi stock market all share index and all sectoral indices using a daily data from 15th October 2006 to 15th November 2012. They used a Unit Root Dickey-Fuller test, Pearson Correlation test, Durbin-Watson test and Wald-Wolfowitz runs-test for a non-stationary series. It was concluded that the all share price index and 11 of the indices followed the weak form of efficiency.

Similarly, Al–Abdulqader, Hannah, and Power (2007) found that 45 listed companies followed the weak form of efficiency by using filter rule strategies. Here, the moving average test and the filter rule strategies were used to test the 45 listed companies, using weekly data from July 1990 to August 2000.

However, Dahel and Laabas (1999) used weekly data from September 1994 to April 1998 to examine if the stock markets of Bahrain, Saudi Arabia, Oman, and Kuwait followed the weak form of efficiency. Different types of tests like unit root test, variance ratio, and autocorrelation were used and demonstrated that Saudi Arabia, Oman, and Bahrain rejected one of the tests (Autocorrelation); while the Kuwait stock market supported the weak form of efficiency in all three tests.

Similarly, Hokroh (2013) concluded that there is no evidence to prove whether the Saudi stock market follows a weak form of efficiency before and after the formation of Tadawul. Daily data over the period from January 1st 2007 to 18th March 2007 (before Tadawul) and from 19th March 2007 to 29th May 2007 (after Tadawul) was used. Autocorrelation and the runs test of randomness were used to test for a weak form of efficiency.

Fattahi (2010) used autocorrelation, variance ratio, and autoregressive tests to examine if the German stock market followed a random walk and if the market followed the weak form of efficiency. The author used daily data from the 2nd January 2004 to 14th March 2005 and showed that the DAX stock market followed a random walk which supported the weak-form efficiency.

Abdmoulah (2009) wanted to investigated the weak-form efficiency of the following Arab countries:- Tunisia, Dubai, Egypt, Qatar, Jordan, UAE (Abu Dhabi index), Bahrain, Morocco, Oman, Saudi Arabia, and Kuwait. He used daily data ending in March 2009 applying the following test GARCH-M (1,1) approach with state-space time varying parameter. His findings showed that all markets followed the weak form of efficiency with high sensitivity to the past shocks.

Haque, Liu, and Nisa (2011) investigated the weak efficiency of the Pakistani Stock Market on weekly data from 2000 to 2001. They used autocorrelation, variance ratio, and runs test and showed that the Pakistani stock market is a weakly efficient market. However, the assessment of previous literature has shown that there is not enough evidence to support that the Saudi stock market has a weak form of efficiency. Therefore, the present study intended to investigate more using different tests and over different time periods.

We concluded that some studies supported the theory that the Saudi stock market is weakly efficient, and other studies made the opposite conclusion that the Saudi stock market is not weakly efficient. Several tests had been used to investigate the efficiency of the Saudi stock market such as unit root test, variance ratio, autocorrelation, filter rule strategies, and moving average test. Since the results of the efficiency of the Saudi stock market were questionable, we reexamined the weak form of efficiency in the Saudi market employing different tests and examining different time period.

3. METHODS

3.1. Study Design

The study follows a quantitative research design, using daily data from 1st January 2012 to 9th January 2019. This time frame has been selected to show different behavior before and after the crisis experienced by Saudi Arabia. For instance, before, 2007 TASI seemed to go into opposite directions in comparison to the Dow Jones Index (DJI); however, later it became more parallel.

The study used the difference of the natural log of the high all share prices return to test for the weak form of

efficiency using Saudi Share Price Index (TASI) high prices from Database of Saudi Stock Exchange Company. EMH changes stock market prices as new information arrives and the current prices reflect all existing publicly available information. Thus, future stock prices can be predicted based on the information of the past prices because they already reflect the current prices. There are different tests of the weak form of efficiency, which allow for measuring how prices are statistically dependent.

The up and down movement of Saudi Stock Exchange was predicted using several publicly available financial data, also known as TASI. The sign of the log return (negative meaning down and positive meaning up) indicated the direction of TASI movement. However, the present study used the high prices of TASI to prove that different Stock exchanges have different trading days. It was also important to mention the use of high values as there is no clear cut off point in time. The movement of direction of TASI in general was investigated by the study using several different methods.

The study basically measured a change at a given day and correlation between consecutive stock price changes. According to Al-Razeen (1997) the efficient market hypothesis in the literature is known as the random walk literature in the 1960s. As of today, changes in prices should not be a strictly random walk or have zero correction between successive price changes. The study can conclude that EMH was invalid unless the dependence of past prices is high.

In the present study, different tests were used to examine if the Saudi stock market has randomness or test the WFMH. The tests included the run test, autocorrelation, unit root test, and variance ratio test. The selection for the test was based on the previous studies that have used these tests (Fattahi, 2010; Haque et al., 2011).

3.2. Data Analysis

The study has applied various tests such as the run test, autocorrelation, unit root test, and variance ratio test, to determine whether the Saudi stock market has randomness or WFMH. The rationale for the selection of the test was based on its effectiveness to produce effectual results as observed in several previous studies apart from entropy analysis (Fattahi, 2010; Haque et al., 2011).

Table-1. Descriptive statistics of the data.

	TASI
Mean	8.93
Median	8.87
Maximum	9.32
Minimum	8.6
Std.Dev	0.16
Skewness	0.53
Kurtosis	2.46
Jarque- Bera	87.29
Probability	0
Sum Sq.Dev	36.37

The descriptive statistics of the daily TASI data is showed in Table 1. The table shows the mean = 8.93, the minimum and maximum values, standard deviation = .16, kurtosis, skewness =.53, and the Jarque-Bera test for the daily data. The descriptive statistics give a historical view of how the Saudi stock market behaves. In the following section we will discuss each of the tests used to determine if the Saudi stock market follows the weak form of efficiency:

- Runs Test (Bradley, 1968): The primary test to check the randomness of the data is a runs test. Mainly, the runs test measures the total number of runs in the selected data and compares that to the expected number of runs. A run can be defined as the sequence of continuous positive or negative signs and each use of continuous positive or negative signs constitutes a run. The idea and test Statistics here is first to count

the number of runs in the data. There are many ways of defining runs in the literature, but they all use the same in the formulation that will give the same sequence of values and results. For instants, for the following sequence of number (1) and number (2) how frequent the series produce in random manner.

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The series has six runs where same signs has one run. A positive sign indicates that return > 0 and a negative sign indicates return < 0 with respect to mean return is thirteen. This is the idea behind the runs test. For larger sample we used the standard normal Z-statistic to conduct a run test as follows:

$$Z = \frac{r - \mu_r}{\sigma_r} \tag{1}$$

Where

$$\mu_r = E(R) = \frac{2n_1 n_2}{n} + 1 \tag{2}$$

$$\sigma_r = \sqrt{\frac{2n_1 n_2 (2n_1 n_2 - n)}{n^2 (n-1)}} \tag{3}$$

- Autocorrelation: The second method to detect if the series follows a random walk is the autocorrelation test which also is known as a serial correlation test. The idea of the autocorrelation is to measure the correlation of current data return and those in the previous periods. If there is a consistent pattern that money could be made exploiting past data then market would not be efficient. For the autocorrelation test, we employ the Ljung-Box statistics by Ljung and George (1978). We expressed the L-box as followed:

$$Q(h) = n(n+2) \sum_{i=1}^{h} \frac{pi^2}{n-i} \tag{4}$$

Where

pi = the accumulated sample autocorrelations,

h = the time lag.

- Unit root test: The third method we will use is to examine the weak form of efficiency and a random walk of a series is the unit root test. Market efficiency demands a non-stationary series in the return of the stock market prices and unit root tests investigate whether time series data is stationary or not. We basically compare the calculated value to the critical value (Mackinnon tabulated value); if the calculated value is less than the critical value we reject the null hypothesis which indicates the series is not stationary. This study uses the Augmented Dickey Fuller test (ADF) to test the unit root in the series. The Augmented Dickey Fuller (ADF) test investigate if the series the possibility of having unit root using an autoregressive (AR) model. AR(1) model can be written as following:

$$\rho_t = \alpha \rho_{t-1} + \varepsilon_t \tag{5}$$

- Variance Ratio Test (VRT): The fourth method used to test the random walk of the data is Variance Ratio Test (VRT). According to Lo and MacKinlay (1988) VRT investigates the predictability of data by comparing variances of differences of the data (return) calculated over different intervals. Assuming our

data follows a random walk, then a period difference of the variance should be times the variance of one period difference.

$$\psi(q) = \frac{\sqrt{nq(var(q)-1)}}{\sqrt{\vartheta\square\square(q)}} \sim b \ N(0,1) \tag{6}$$

4. RESULTS

4.1. Runs Test

One of the most common tests of the weak form of efficiency is the runs test. Table 2 shows the runs test results for the selected period of the study. The p-value clearly shows that it is smaller than the alpha (.005); and therefore, significant. This indicated that the z-value does not fall between ±1.96 indicating that TASI is not random. Therefore, the runs test results do not follow the weak form of efficiency.

Table-2. Runs test.

TASI Runs Test Variables	Number of Observations	P-Value
Run	678	0.00
Above Cutoff	825	
Below Cutoff	681	
Total	1506	

4.2. Autocorrelation

Autocorrelation is one of the methods to investigate the weak-form of efficiency and the randomness of the series. The study employed the Ljung-Box statistics as an indicator of autocorrelations. Table 3 shows that Saudi stock market does not follow the weak form of efficiency for at the selected period. The study finding was consistent with the runs test findings stating that there was no evidence that the TASI follows a weak form of efficiency.

Table-3. Autocorrelation for sample from 01/01/2012 to 01/01/2019.

Number of Lags	AC	Q-Stat	Prob
1 Lag	0.557	467.57	0.000
2 Lags	0.078	476.82	0.000
3 Lags	0.039	479.08	0.000
4 Lags	0.035	480.96	0.000
5 Lags	0.034	482.72	0.000
6 Lags	-0.008	482.81	0.000
7 Lags	-0.059	488.15	0.000
8 Lags	-0.043	490.89	0.000
9 Lags	-0.008	490.98	0.000
10 Lags	0.009	491.11	0.000

Notes: *, **, and ***denotes statistical significance at 10%, 5% and 1% respectively.

4.3. Unit Root Test

To test for unit root, the Augmented Dickey-Fuller test (ADF) was used. Table 4 shows the results of the Unit Root Test which indicated that the series of TASI has no unit root. The ADF test statistic is -9.43, which was smaller than the MacKinnon tabulated value at 1% and 5% Table 4. It concluded that the TASI does not follow the weak form of efficiency at the selected periods, which was consistent with the results of the runs test and autocorrelation test.

Table-4. Augmented dickey-fuller test from 1/1/2012 to 1/1/2019.

Variables		t-statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.430270	0.0000
Test critical values	1% level	-3.434528	
	5% level	-2.863275	

4.4. Variance Ratio Test (VRT)

The first test specification used was under the assumption of homoscedastic using asymptotic distributional. The second test specification was used under the assumption of heteroscedastic using asymptotic distributional. The results of the Variance Ratio test under both assumptions are shown in Table 5. In other words, a joint probability value was less than alpha 5% and the joint z-statistic does not fall between ± 1.96. Therefore, the variance ratio does not ≠ 1 under both homoscedasticity and heteroscedasticity. The study found that the Variance ratio test was consistent with the previous results that the TASI market does not follow the weak form of efficiency.

Table-5. VRT joint probability from (1/1/2012 to 01/01/2019).

Variance Ratio Test	Under Homoscedastic	Under heteroscedastic
Joint z-statistic value	9.400830	4.488984
Joint probability value	0.0000	0.0000

5. DISCUSSION

The study has examined weak form of efficiency in the Saudi stock market return. The result indicates that the TASI does not follow the weak form of efficiency. This was in line with the findings of Elango and Hussein (2008) based on the nature of the market, given its emerging aspects. As per the results of the autocorrelation test, the study concluded similar results stating that the Saudi stock market is not weakly efficient. Al Ashikh (2012) also found a parallel to the current study indicating the absence of weak efficiency in the stock market. Reflecting upon the unit root test results, it was found that TASI does not follow a weak form of efficiency which was consistent with the runs tests and autocorrelation test. The variance ratio test indicated similar results to the previous tests that the Saudi stock market does not follow the weak form of efficiency.

On the contrary, Asiri and Alzeera (2013) showed that Saudi stock prices tend to exhibit unit root for the all share index and the individual sectors, except for the banking and financial services sector. There was no significant correlation between all the shared indices including the daily returns. Other indices did not show any strong or even moderate relationship between the daily returns. The study results could not conclude whether the daily returns of the indices followed a random walk or not. However, the results provided evidence that the market of Saudi Arabia's TASI was weak-form efficient. The Share general market index of Saudi Arabia and 11 indices fulfil the properties of weak-form efficiency of EMH.

6. SUMMARY AND CONCLUSION

The overall results of the study concluded that the Saudi stock market does not follow a weak form of efficiency; however, more investigations are needed to better understand some of the variations of the Saudi stock market prices. The run test results indicated that the TASI does not follow the weak form of efficiency. The results add value to the existing body of literature on using the random walk hypothesis for evaluating the weak-form market efficiency in the emerging markets, more specifically in the GCC countries. These results serve as a preliminary point for future studies assessing the semi-strong form of EMH in Saudi Arabia. A possible extension is to look at each sector of the Saudi stock market and test each sector if it follows a weak form of efficiency. Along with it, the market needs to be further studied in terms of various samples, time series, and further tests to confirm market efficiency as well as the day-of-the-week effect.

It is expected that the market lacks the investor capable of making extreme returns depending on previous information and technical examination to frame trading decision and neglecting the market on a continuous and systematic base. It is expected that the investors in the market of Saudi Arabia would be able to generate excessive returns through the past information and technical analysis to formulate trading decision. They would be able to beat the market on a continuous and systematic basis. The study findings have enhanced knowledge concerning the weak-form market efficiency in the emerging markets, especially in the MENA region and GCC countries. The

results recommend conducting further studies to test the semi-strong form of EMH in Saudi Arabia. Future studies also need to focus on the adoption of correction and regulations by the policymakers in the Saudi stock market.

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