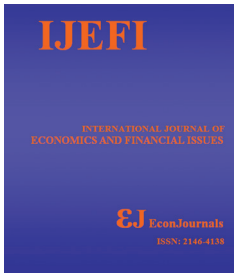

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Regional Stock Market Efficiency at Weak Form after the Covid-19 Vaccination approval

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ABSTRACT

The contradiction in the previous results provides a deep avenue for researchers to take more interest in the stock market efficiency and conduct more studies. Therefore, the study objective is to decide whether the Arab Federation of Exchanges (SandP AFE 40 Index Return) is efficient at weak-form based on normality and random walk hypothesis using several statistics such as the Jarque-Bera test as a parametric technique to check the normality and the Augmented Dickey-Fuller test as a parametric method to test the random walk hypothesis. Moreover, the results are reinforced by six non-parametric techniques to test the normality hypothesis such as the Kolmogorov-Smirnov test, Shapiro-Wilk test, Lilliefors test, Cramer-von Mises test, Watson test, Anderson-Darling test, and four non-parametric techniques such as run test, variance ratio test, Phillips-Perron test, and autocorrelation test to check the random walk hypothesis for daily data after the Covid-19 vaccination program over the period from 31 March 2020 to 31 March 2023, the results of all tests indicated that the market index return is non-efficient at the weak form, and concluded that the investors could analyze the Arab Federation of Exchanges' past stock prices or other historical data as opportunities to predict future stock prices and earn unusual profits; therefore, Policymakers may further improve access to information to prevent investors from having opportunities to predict stock movements to obtain abnormal returns.

Keywords: Information and Market Efficiency, Stock Market, Arab Federation of Exchange, Normality, Random Walk
JEL Classifications: G14, G15, G19, G34, C12

1. INTRODUCTION

The market efficiency concept plays an essential function in understanding the dynamics of stock markets. Theoretically, market efficiency evaluates how well financial markets consolidate and reflect all available relevant information (El-Diftar, 2024). Accordingly, stock market efficiency refers to the ability of prices to quickly and accurately reflect relevant information, making it impossible for investors to gain unusual returns consistently (Asaad, 2014; Rahimah et al., 2018; Marsani et al., 2022). Market efficiency encompasses three eminent forms: weak, semi-strong, and strong (Garikai Bonga et al., 2023).

The study focuses on efficiency in weak form, which assumes that all historical prices are already included in current stock prices (Zebende et al., 2022), meaning it is nearly impossible to use historical information alone to outperform the market consistently. The debate on market efficiency continues; understanding the weak form is essential for investors seeking to navigate the complexities of the stock market (Faisal et al., 2022).

Mixed results were found in the literature on the stock price movement to accept the market efficiency hypothesis (Nurunnabi, 2012; Karasinski, 2020; Faisal et al., 2022). Some studies found that stock prices do not follow a random walk (Hawaldar et al.,

2017; Ahmed and Hossain, 2019; Houfi, 2019; Al-Faryan and Docker, 2021; Dias et al., 2022). In contrast, others found that the movement of stock prices is unpredictable (Asiedu et al., 2020; Marsani et al., 2022; Zebende et al., 2022). Therefore, the contradiction in the results provides a deep avenue for scientists, researchers, academics, and practitioners to take more interest in this topic and conduct more studies on the subject.

In this regard, this study aims to assess the stock price efficiency at weak form to fill the gap in the literature due to neglecting the concentrating on the most prominent regional stock market index in the region, therefore examining this specific index is important and adds value to the understanding of market efficiency in the MENA region due to this index consisting of the 40 largest and most liquid securities from the MENA region. Because of that need to undertake the current study contributes to the existing literature on the market efficiency of a weak form of Arab Federation Exchange (SandP AFE 40 Index return) using a parametric and non-parametric test.

The motivation for this study is to understand if investors can analyze this regional stock market's past prices and other historical information as opportunities to predict future stock prices and then earn unusual profits. Also, to help the decision makers of investment in the MENA region stock market and increase their understanding of the pricing process prevalent in the stock market, policymakers may further improve access to information to prevent investors from having opportunities to predict stock movements to obtain abnormal returns. The study is structured as follows, market efficiency and literature review in section two, methodology in section three, results in section four, and conclusions in the last section.

2. MARKET EFFICIENCY AND LITERATURE REVIEW

2.1. Market Efficiency Background

The study hypotheses developed based on the results of previous works on the weak level as a first form of the Efficient Market Hypothesis (EMH) as a cornerstone concept in financial economics (Jethwani and Achuthan, 2013), and an essential factor for investors' tendency to diversified portfolios globally, making stock prices reflect all publicly available information (Haroon, 2012), therefore to assure that not fruitful to use the historical data or technical analysis to predict the movements of future stock prices in order to have abnormal profits. The EMH categories are divided into three forms: weak, semi-strong, and strong forms, depending on the type of information that is reflected in stock prices (Diftar, 2024).

Many studies results confirmed that developed markets are efficient in weak form (Mustafa, 2004; Sapate and Ansari, 2011; Chiwira and Muyambiri, 2012), but still, the studies concentrated on the efficiency in developing or emerging markets at weak form.

2.2. Weakly Efficient in Emerging Stock Markets

Some past study results confirmed that the stock market's efficiency is weak in emerging markets. Haroon (2012) employed the KS Goodness-of-Fit test, run test, and autocorrelation test to find out the serial independency of the Karachi stock exchange from November 1991 to November 2011, and found that the Pakistani stock market is weak-form efficient.

Further, Hailu and Vural, (2020) analyzed the weak-form efficiency of the various Borsa Istanbul indexes using weekly adjusted closing prices daily data from January 2010 to December 2019. Part of the results found that the market is weak-form efficient. The study results in direct with Gozbasi et al. (2014), and compatible with Chen and Metghalchi (2012) study from January 1996 to January 2011. Likewise, Singh and Spana (2013) found that Hong Kong and Bombay stock exchanges are efficient at weak form using the autocorrelation test, Box-Ljung statistics, and runs test for the period January 2003 to March 2011, the same result found by Patel et al. (2012) study in Bombay Stock Exchange and Shanghai Stock Exchange for the period January 2000 to March 2011.

The Middle East and North Africa (MENA) cover nineteen countries, according to the OHCHR headquarters in Geneva: six members from North Africa, six members from GCC, and eight members out of both. Several studies have assured that the stock market's efficiency is weak in the MENA region. For instance, a study done by Lahmiri (2013) study of the Jordan and Saudi stock markets. Moreover, the results are consistent with Moustafa (2004) study in the U.A.E from October 2001 to September 2003, utilizing only the nonparametric runs test for randomness.

The evidence of the market weakly efficient was also presented by Garikai Bonga et al. (2013) in Zimbabwe Stock Exchange using monthly from January 2020 to February 2022, Faisal et al. (2022) using daily data from Indonesian Stock Exchange for two periods pre-during covid-19 from January 2011 to December 2021, Asiedu et al. (2020) in the mining and petroleum sector in Ghana stock exchange utilizing monthly returns from January 2010 to December 2016, Marsani et al. (2022) in Malaysia extreme stock return during the financial crisis and recovery period, Zebende et al. (2022) in the world's wealthiest countries (G-20 group) for time-scale shorter than five days from May 2019 to May 2020.

Accordingly, the studies indicate that many emerging markets and MENA stock markets are efficient at weak form, meaning that investors cannot analyze past stock prices and other historical data as opportunities to predict future stock prices and then earn unusual profits.

2.3. None-Weakly Efficient in Emerging Stock Markets

Several studies' results confirmed that the stock market is inefficient at a weak form in emerging markets. Ahmed and Hossain (2019) studied the weak-form efficiency of the Bangladesh stock market using daily data of twenty-six leading companies from 2011 to 2017, and the results indicated that the market was not weak-form efficient. In addition, similar results generated by Pervez et al. (2018) showed inefficiency in the Bangladesh stock exchange using both non-parametric and parametric tests for daily returns from June 2004 to March 2018. Meanwhile, this result is in harmony with Wen et al. (2010), who tested two

Chinese stock markets (Shenzhen and Shanghai) employing the GARCH amended model and the AR-X-GARCH for the period from January 2001 to July 2009. The same result was found by Patel et al. (2012) study in Hong Kong Stock Exchange and Tokyo Stock Exchange for the period January 2000 to March 2011 using the run test, unit root test, autocorrelation test, and variance test.

Similarly, Jethwani and Achuthan (2013) tested the weak-form efficiency of the Indian stock market during, before, and after the financial crisis using daily data from January 1996 to December 2012 using autocorrelation, variance ratio test, Kolmogorov Smirnov test, and run test to examine the random walk hypothesis. The results showed that the Indian stock market was not weak-form efficient in all periods. This finding was confirmed by Nikita and Soekarno (2012) using an autocorrelation test, run test, and regression analysis for the period January 2008 to December 2011 in the Indonesian stock market. In the same market, Rahimah et al. (2018) used a run test, unit root test, and autocorrelation test of thirty-four weekly stock prices from January 2011 to December 2016, and the results confirmed that this market is inefficient at a weak level.

In addition, Khan and Vieito (2012) investigated the Euronext Lisbon market efficiency using a serial correlation test, runs test, unit root test, multiple variance ratio test, ranks, and signs test for the daily Portuguese stock index closing stock prices traded for the period from October 1998 to May 2008. The results indicated that the Portuguese market is inefficient in a weak form. In addition, Dragotă and Tilică (2013) found mixed results on the efficiency of twenty eastern European former communist markets from January 2008 to December 2010 using the unit root test, run test, variance ratio, filter rules test, and the January effect.

Various studies in the literature review proved that the stock market is inefficient at a weak form in the MENA region. Al-Ajmi and Kim (2012) conducted a study on the weak-form efficiency of the stock markets in the Gulf Cooperation Council (GCC) countries using three new multiple variance ratio tests, such as joint tests, variance ratio tests, and wild bootstrap tests based on different periods. The results revealed that the GCC stock markets were not weak-form efficient.

This finding is consistent with Asaad (2014) study of the Iraqi bank stock market using the Jarque-Bera test, Lilliefors test, Cramer-von Mises test, Watson test, Anderson-Darling test, Augmented-Dickey Fuller, Phillips-Perron and runs test for the period July 2004 to March 2014, and study done by Asaad et al. (2015) for the daily closing price of Iraqi stock index using Kolmogorov-Smirnov test, Shapiro-Wilk test, Cramer-Von Mises test, Watson test, Anderson-Darling test, Augmented Dickey-Fuller test, Phillips-Perron test, run test, and autocorrelation test for the period January 2010 to January 2014. Besides, Hawaldar et al. (2017) rejected the efficiency of the weak form in Bahrain Bourse using the Kolmogorov-Smirnov test, run test, and autocorrelation test covering the period of 2011 to 2015. Furthermore, Houfi (2019) found that the Tunisian stock index is inefficient in weak form for the period from February 1998 to March 2018 using ARFIMA and FIGARCH processes. This study gives the same results as Abushammala (2011), which found non-efficient in the weak form of the Palestine stock market using the Augmented Dickey fuller test, the Phillips-Perron test, and the Kwiatkowski-Phillips-Schmidt-Shin test covers the daily data from January 2007 to December 2010.

Furthermore, Lahmiri (2013) investigated the weak-form efficiency of the stock markets in the MENA region using daily data from January 2010 to September 2012, employing the three-variance ratio test to examine the random walk hypothesis. The results indicated that the Saudi and Jordan market is weak-form efficient; in opposite, the Kuwait, Tunisia, and Morocco Markets are inefficient. This finding agrees with Abdmoulah (2010), who found that all eleven Arab stock markets (Saudi Arabia, Kuwait, Tunisia, Dubai, Egypt, Qatar, Jordan, Abu Dhabi, Bahrain, Morocco, and Oman) are inefficient at weak form using GARCH-M for the different period based on the individual market from 2000 to 2009. Salameh (2011) also presented evidence of the inefficiency in the weak form of twelve Arab stock markets using the serial correlation test, the Augmented Dickey-Fuller test, the runs test, and the Phillips-Perron test from January 2009 until November 2010. It also agrees in some way with another study done by Al-Nassar (2021) in the Saudi Arabia stock market and Almujamed, (2018) in the Qatari stock exchange.

The evidence of a non-weakly efficient market also presented by El-Diftar (2024) in nine major emerging markets using daily returns from 2015 to 2020, Lee and Ande (2022) in Indonesian Stock Exchange using daily data for two periods pre-during covid-19 from January 2017 to December 2020, Al-Faryan and Dockery (2021) in Saudi stock market using weekly and monthly data for two periods pre-post corporate governance change from 1994 to 2016, Diallo et al. (2021) in the regional stock exchange (West African Economic and Monetary Union) utilizing daily data from December 2013 to January 2019, Elangovan et al. (2021) in Indian stock market employing daily data from January 2011 to December 2020, Khoj and Akeel (2021) in Saudi Arabia stock market using daily data from January 2012 to January 2019; Dias et al. (2022) in comparative among six African markets, the UK, Japan, and the USA pandemic period from September 2019 to September 2020.

Accordingly, the studies indicate that many emerging markets and MENA stock markets are non-weak form efficient, meaning that investors can analyze past stock prices and other historical data as opportunities to predict future stock prices and then earn unusual profits.

2.4. Study Gap

In conclusion, based on the review of the above past studies, and found that the results are mixed in emerging countries and MENA stock markets at a weak form of efficiency due to several studies' results confirming the market efficiency, while some others did not present evidence of market efficiency. Therefore, the contradiction in the results provides a deep avenue for scientists, researchers, academics, and practitioners to take more interest in this topic with the need to conduct more studies due to the stock market reaction to different events like diseases or even political change and violence (Asaad, 2021).

The study may consider a first endeavor to test the efficiency at weak-form of the MENA largest regional stock market indices for the period after the COVID-19 vaccination approval. Yet, there is almost no evidence or lack of studies within the literature review of new regional stock indices, such as the SandP Pan Arab, that have not been examined for weak-form market efficiency at all. Therefore, this study seeks to address this research gap.

3. METHODOLOGY

3.1. Objective and Hypotheses

The study objective is to decide whether the daily (SandP AFE 40) Index return is efficient at weak-form based on randomly distributed by using various parametric and nonparametric tests from 31 March 2020 to 31 March 2023. Thus, the study hypothesis developed to test the efficiency at weak form as follows:

H_0: The daily SandP AFE 40 index return historical data cannot be used to predict future stock prices to create abnormal profits (weak form efficiency).

H_1: The daily SandP AFE 40 index return historical data can be used to predict future stock prices to create abnormal profits (not weak form efficient).

3.2. Sample

The study sample used one of the most significant regional market indices by focusing on the daily SandP AFE 40 index return, which consists of the 40 largest and most liquid securities from the MENA region covering the period after the Covid-19 vaccination approval from 31 March 2020 to 31 March 2023 for a total of (928) observations transferred in natural logarithm. The daily time series was collected from (the SandP Dow Jones Indices: A division of the SandP Global website) to test the hypotheses and explore the results by employing the SPSS26 and Eviews12 statistical packages.

3.3. Statistical Methods

The suitable and most commonly used test based on the literature review is employed in this study to examine the normality hypothesis and random walk in assessing weak-form efficiency; normality is considered one of the basic assumptions underlying stock market efficiency at weak-form (Salameh et al., 2011). Descriptive statistics identified the pattern of the stock market index return to show whether the data is a normal distribution. Then, several statistical methods were used to test the study hypothesis, like the Jarque-Bera test as a parametric technique to check the normality and the Augmented Dickey-Fuller test as a parametric technique to test the random walk hypothesis. Moreover, the results are reinforced by six non-parametric techniques to test the normality hypothesis such as the Kolmogorov-Smirnov test, Shapiro-Wilk test, Lilliefors test, Cramer-von Mises test, Watson test, Anderson-Darling test, and four non-parametric techniques such as run test, variance ratio test, Phillips-Perron unit root test, and Autocorrelation test to check the random walk hypothesis.

4. RESULTS

4.1. Descriptive Statistics

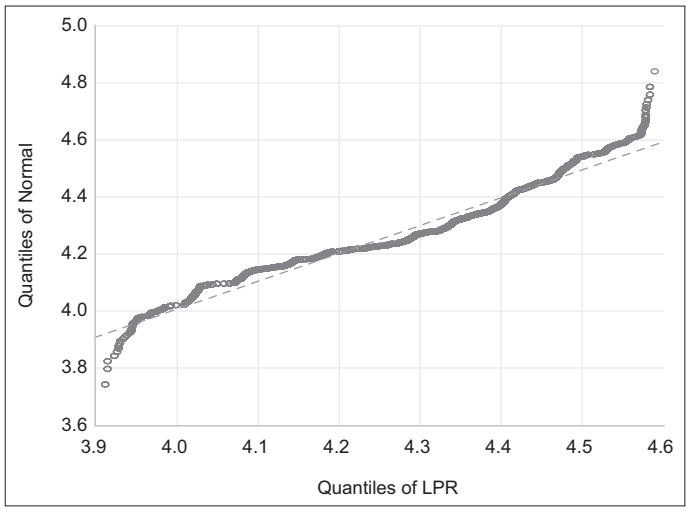
The non-stationary is discovered in Figure 1 based on the graphical check of the daily SandP AFE 40 Index return covering the period after the Covid-19 vaccination approval from 31 March 2020 to 31 March 2023 for a total of (928) observations, the Q-Q plotted in Figure 2, and confirmed that the index return does not follow normality due to points far from the line. In addition, the series of descriptive statistics shown in Table 1 that the index skewness and kurtosis indicated the deviation from normality around the mean.

4.2. Parametric Test

The study used the Jarque-Bera test as a parametric technique to test the normality hypothesis and the Augmented Dickey-Fuller test as a parametric technique to test the random walk hypothesis, as shown in Table 2; the results show that the SandP AFE 40 index return does not follow the normality assumption due to the rejecting the null hypothesis because the p-value is less than the significance level at (1%) based on the Jarque-Bera Test. Moreover, the results show that the SandP AFE 40 index return does not follow the random walk assumption due to rejecting the null hypothesis because the p-value is less than the significance level at (1%) based on the Augmented Dickey-Fuller test.

Figure 1: Movements of Daily S&P AFE 40 Index Return

Figure 2: Q-Q Plot of Daily S&P AFE 40 Index Return



4.3. Non-Parametric Test

The study employed six non-parametric techniques to test the normality hypothesis and four non-parametric techniques to test the random walk hypothesis, as shown in Table 3; the results show that the SandP AFE 40 index does not follow the normality assumption due to the rejecting the null hypothesis because the p-value is less than the significance level at (1%) based on the Kolmogorov-Smirnov test, Shapiro-Wilk test, Lilliefors test, Cramer-von Mises test, Watson Test, and Anderson-Darling test. Moreover, the results show that the SandP AFE 40 index does not

Table 1: Descriptive statistics of daily S&P AFE 40 Index Return

Index	Mean	Median	Maxi.	Mini.	Std. Dev.	Skewness	Kurtosis
SandP AFE 40	4.290033	4.332311	4.589853	3.911823	0.167997	−0.416541	2.184476

Asterisk (*) denotes the null of normality was rejected at the 1% significance level.

Table 2: Parametric test for S&P AFE 40 Index Return efficiency

No.	Test	Statistics	Probability	
1.	Jarque-Bera Test	52.55202	0.000000	
		Constant	Intercept and Trend	None
2.	Augment Dickey-Fuller Test	−25.85370*	−26.10919*	−25.78133*
	CV 1%	−3.437190	−3.967990	−2.567462
	CV 5%	−2.864449	−3.414674	−1.941165
	CV 10%	−2.568372	−3.129492	−1.616469

The null of normality was rejected at the 5% (**), 1% (*) significance level.

Table 3: Non-parametric test for S&P AFE 40 Index Return Efficiency

No.	Test		Statistics	Probability
1.	One-Sample Kolmogorov-Smirnov Test		0.104	0.0000
2.	Shapiro-Wilk Test		0.956	0.0000
3.	Lilliefors Test		0.104131	0.0000
4.	Cramer-von Mises Test		2.586071	0.0000
5.	Watson Test		2.586071	0.0000
6.	Anderson-Darling Test		14.41627	0.0000
7.	Runs Test (Z-Statistic)		-30.085	0.0000
8.	Variance Ratio Test (Z-Statistic)			
	VR (2)		1.162541	0.0004
	VR (4)		1.309144	0.0004
	VR (8)		1.476119	0.0005
	VR (16)		1.444080	0.0239
	VR Joint Test		3.534191	0.0016
		Constant	Intercept and Trend	None
9.	Phillips-Perron Test	−26.07377*	−26.26906*	−26.01687*
	CV 1%	−3.437190	−3.967990	−2.567462
	CV 5%	−2.864449	−3.414674	−1.941165
	CV 10%	−2.568372	−3.129492	−1.616469
		AC	Box-Ljung Statistic	
			Value	Probability
10.	Autocorrelation Test			
	Lag			
	1	0.996	924.354	0.000
	2	0.993	1842.634	0.000
	3	0.989	2755.282	0.000
	4	0.985	3662.048	0.000
	5	0.981	4562.617	0.000
	6	0.978	5457.409	0.000
	7	0.974	6347.210	0.000
	8	0.971	7232.155	0.000
	9	0.968	8112.765	0.000
	10	0.965	8989.023	0.000
	11	0.962	9860.630	0.000
	12	0.959	10727.514	0.000
	13	0.956	11590.410	0.000
	14	0.953	12448.859	0.000
	15	0.950	13301.936	0.000
	16	0.946	14149.637	0.000

The null of normality was rejected at the 5% (**), 1% (*) significance level.

Table 4: Results Summary

Hypothesis	Test	Result	Coherent with	Incoherent with
Parametric Test				
Normality	Jarque-Bera test	Not Normal	Wen et al. (2010), Irfan et al. (2011), Patel et al. (2012), Jethwani and Achuthan, (2013), Houfi (2019), Marsani et al. (2022), Garikai Bonga et al. (2023)	Hailu and Vural (2020)
Random Walk	Augmented Dickey-Fuller test	Not Random	Abushammala, (2011), Salameh et al. (2011), Asaad (2014), Asaad et al. (2015), Pervez et al. (2018), Houfi (2019), Khoj and AKeel (2020)	
Non-Parametric Test				
Normality	Kolmogorov-Smirnov, Shapiro-Wilk, Lilliefors, Cramer-von Mises, Watson, Anderson-Darling test	Not Normal	Haroon (2012), Jethwani and Achuthan (2013), Asaad et al. (2015), Hawaldar et al. (2017), Pervez et al. (2018) Irfan et al. (2011), Asaad (2014), Asaad et al. (2015)	Karasiński, (2020)
Random Walk	Run test, Variance Ratio, Phillips-Perron, Autocorrelation test	Not Random	Abushammala (2011), Salameh et al. (2011), Al-Ajmi and Kim (2012), Khan and Vieito (2012), Nikita, and Soekarno (2012), Patel et al. (2012), Lahmiri (2013), Jethwani and Achuthan (2013), Asaad et al. (2015), Hawaldar et al. (2017), Ahmed and Hossain (2019)	Haroon (2012), Singh and Sapna (2013), Pervez et al. (2018), Garikai Bonga et al. (2023)

follow the random walk assumption due to the rejecting the null hypothesis because the p-value is less than the significance level at (1%) based on the runs test, variance ratio test, Phillips-Perron unit root test, and autocorrelation test.

The results compared with previous studies applied in various developing or emerging stock markets according to the statistical methods used to test the normality and the random walk assumption, as shown in Table 4.

Briefly, the test results point out that the SandP AFE 40 Index return does not follow the normality assumption, indicating that the null hypothesis is rejected and the alternative hypothesis is accepted, meaning the index return is not normally distributed according to the parametric test such as the (Jarque-Bera test), and non-parametric tests such as (Kolmogorov-Smirnov, Shapiro-Wilk, Lilliefors, Cramer-von Mises, Watson, Anderson-Darling test), also the test results point out that the SandP AFE 40 index return does not follow the random walk assumption according to the parametric test such as the (Augmented Dickey-Fuller test), and non-parametric tests such as (run test, variance ratio, Phillips-Perron, autocorrelation test), meaning that the investors can earn abnormal rate of profits using historical data of index return, therefore the regional market is not efficient at the weak level based on the test results in Table 4.

5. CONCLUSION

In brief, this study aims to analyze the efficiency of MENA region proxied via Arab Federation Exchanges daily prices (SandP AFE 40 index return) for the period after the Covid-19 vaccination approval from 31 March 2020 to 31 March 2023, which have been found nonefficient in weak form based on the results of several statistical methods used to test the study hypothesis like the Jarque-Bera test as a parametric technique to check the normality and the Augmented Dickey-Fuller test as a parametric technique to test the random walk hypothesis. Moreover, the results are reinforced by six non-parametric techniques to test the normality hypothesis such as the Kolmogorov-Smirnov test, Shapiro-Wilk test, Lilliefors test, Cramer-von Mises test, Watson test, Anderson-Darling test, and four non-parametric techniques such as Runs Test, Variance Ratio Test, Phillips-Perron unit root test, and Autocorrelation test to check the random walk hypothesis. The study cannot accept the null hypothesis and concludes that investors can analyze this regional stock market's past prices and other historical information as opportunities to predict future stock prices and then earn unusual profits. Also, the study findings will be helpful to the decision makers of investment in the MENA region stock market and increase their understanding of the pricing process prevalent in the stock market; therefore, policymakers may further improve access to information to prevent investors from having opportunities to predict stock movements to obtain abnormal returns.

Additionally, one of the study limitations is the sample period is limited to a relatively short timeframe after the COVID-19 vaccination approval, which may not provide a comprehensive assessment of market efficiency. In regards to further studies, the Arab Federation Exchanges need to be explored using all individual forty largest and most liquid listed stocks in the (SandP AFE 40 index return) to test this regional stock exchange efficiency at the weak form and extend to consider the semi-strong and strong form of efficiency, even increasing the sample period is possible by comparing the efficiency at weak form between pre and post the Covid-19 pandemic or vaccination program.

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