“Testing the weak-form efficiency of Arab stock markets after the COVID-19 pandemic”

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TESTING THE WEAK-FORM EFFICIENCY OF ARAB STOCK MARKETS AFTER THE COVID-19 PANDEMIC

Abstract

Weak-form efficiency means that stock prices should reflect all historical information and follow a random walk. This study examines the effect of the COVID-19 pandemic on the stock market weak-form efficiency of Arab countries, namely, Jordan, Lebanon, Kuwait, Morocco, Oman, Palestine, Bahrain, Egypt, Iraq, Qatar, Saudi Arabia, the United Arab Emirates, Syria, Tunisia, and Sudan. Daily data from July 1st, 2021 to November 12th, 2022 (370 trading days) are used to cover the period after starting the pandemic. The variance ratio and the runs test are used to test return predictability. The results show that the variance ratio values of Boursa Kuwait, the Egyptian Exchange, Tadawul, and the Amman Stock Exchange are statistically significant, indicating that their returns are unpredictable. In specific, the indices of these stock markets follow a random walk, and their price changes are independent. This is evidence that these stock markets are efficient at a weak level. In contrast, the insignificant values of the variance ratio indicate that returns are predictable in other Arab stock exchanges after the pandemic era. The findings of the Egyptian Exchange, Tadawul, and the Amman Stock Exchange are confirmed using the run test of weak-form efficiency. It reveals that the indices of these stock exchanges follow a random walk, while the indices of other Arab stock markets do not.

Keywords efficiency, weak form, Arab, stock markets, variance ratio, runs test, COVID-19

JEL Classification G10, G14, G19

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INTRODUCTION

Not only human lives have been badly harmed by the coronavirus pandemic, but also the world economy and financial markets. To contain the pandemic, numerous nations have been forced to implement lockdowns, travel restrictions, social segregation, and border closures. At all sizes, these operations have a significant effect on supply chains, economic activity, and global trade. In the midst of this worldwide epidemic, financial markets have also seen a significant disruption due to an aggressive global revaluation and adjustment process. For instance, on March 16, 2020, the S&P 500 index fell by about 12%, and the Dow Jones Industrial Average fell by 12.9% (CFI report, 2022). After the tragic "Black Monday" crash of 1987, it was the worst decline. Since the epidemic has significantly limited economic activity through protective measures and the postponement of important events, stock markets are in a state of upheaval. According to the policy brief from the "Union of Arab Banks" and the "United Nations Economic and Social Commission for Western Asia" (ESCWA), Arab stock markets lost 25% of their value in the first quarter of 2020.

Market efficiency is a hypothesis that was first introduced by Fama (1970). It supposes that stock prices should incorporate all past, public, and even insider information. The hypothesis is grounded on the

random walk theory, stating that stocks move randomly, and thus, no investor can predict their values. Financial analysis is useless, and passive portfolio management is preferred. Moreover, stocks are fairly priced, and returns are not correlated with their historical values. This study focuses on the weak form of efficiency "in which stock prices should reflect all historical information". Accordingly, future stock values cannot be predicted using historical price data if the weak-form market efficiency hypothesis holds. Similarly, abnormal returns could not be obtained, and markets cannot be outperformed. Specifically, this study tests the weak-form efficiency of Arab stock markets after the coronavirus pandemic using daily data from July 1st, 2021 to November 12th, 2022.

1. LITERATURE REVIEW

Many researchers have examined how the epidemic has affected stock exchanges. Ozkan (2021) examines how the unique coronavirus pandemic has affected stock market efficiency for six wealthy nations that have been particularly badly hit: the UK, the USA, Spain, Italy, Germany, and France. Using daily stock market data from 2019 to 2021, the results show that all stock markets employed in this study diverge from market efficiency at different points throughout the pandemic. During the COVID-19 epidemic, there were larger deviations from market efficiency in the UK and the US stock markets compared to other stock markets. The study's conclusions indicate a higher likelihood of anomalous returns and stock price forecasts during the coronavirus epidemic.

The effect of the coronavirus pandemic on the financial markets of "G-20" nations is investigated by Singh et al. (2020). Panel data regression is used to elucidate the reasons for abnormal returns (ARs), and an event study approach is employed to assess ARs. The "G-20" nations' indices compose their sample. The estimate window is 150 days prior to the event date, and the window used is 58 days following the report of the COVID-19 pandemic in the worldwide media. The four sub-event windows across the 58-day period exhibit statistically significant negative ARs, according to the results. Both developed and emerging nations must consider negative ARs. The results of this analysis demonstrate that heightened stock market terror created by a rise in coronavirus-positive cases in the "G-20" nations caused the negative "cumulative average abnormal return (CAAR)" during "day 0 to day 43". The rebound of stock markets succeeding a significant stock price correction caused by coronavirus is shown by the negative CAAR, during "day 43 to day 57". Furthermore, panel data analysis results validate that stock markets have recovered from COVID-19's detrimental effects.

Industry portfolios are used as test assets by Lalwani and Meshram (2020) to examine if stock markets' informational efficiency has declined since the beginning of the COVID-19 crisis. They make use of data from twelve US industries. The findings imply that throughout the COVID-19 era, there has been a rise in the predictability of stock returns in a few industries, including manufacturing, telecom, finance, business equipment, and retail and wholesale shops. Throughout the COVID-19 crisis, it appears that markets were less informationally efficient.

Azyadat and Asfoura (2021) investigate how the coronavirus epidemic has affected the stock market in "Saudi Arabia". The research was based on daily data from the "Tadawul All Share Index" (TASI), from March 15, 2020, to August 10, 2020. Based on the correlation matrix and Impulse Response Function (IRF) analysis, it demonstrates that stock market returns throughout the pandemic reacted adversely to the increase of coronavirus-infected patients. The coronavirus pandemic's negative effects on KSA stock market performance were validated by the ARCH model's results. The findings also revealed that early in the coronavirus epidemic, there was a significant negative market reaction. According to the study's findings, the stock market in Saudi Arabia reacted swiftly to the coronavirus pandemic, though the timing of the response differed according to the pandemic's stage. Nonetheless, the incentive package's magnitude and the Saudi government's promptness in responding to the COVID-19 outbreak have significantly lessened its negative effects on the Saudi stock market.

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Driss and Garcin (2021) investigate how coronavirus has affected the financial markets. They find that when the coronavirus scenario is applied to stock indices, a significant loss of efficiency is shown for the US indices. Conversely, Australian and Asian indices are less impacted, and it is even debatable if these markets were inefficient during the COVID-19 issue.

Ferreira's (2021) analysis centers on the Chinese stock market, as it was the first to be impacted and had the most time to respond. They analyze the effect of coronavirus on the effectiveness of the Chinese stock market using minute-based data and a sliding windows technique utilizing the detrended fluctuation analysis. The findings indicate that there was turbulence in the Chinese stock market with a high degree of dependency, but the market responded fast, and the turbulence eventually returned to its efficient pattern. This is a highly pertinent conclusion that demonstrates how rapidly this specific stock market responds to instances of volatility – information that is crucial for investors to know.

Vasileiou (2020) investigates the reactions of the world`s greatest financial market, the S&P 500 index, during the coronavirus pandemic. They evaluate the news, which is provided with the corresponding market performance, using a straightforward financial and business analysis that uses the Constant Growth Model. This allows them to determine if the stock market consistently considers new information as it becomes available. The runs-test reinforced their hypotheses that the US stock market was inefficient throughout the coronavirus epidemic, and they demonstrated that the market was not moving as predicted in many sub-periods. They discover that occasionally the market is nonsensical, unreasonable, and does not immediately absorb the news. This study shows that although even the most fundamental financial theories might explain rational behavior, the market's performance was dissimilar, all of which make it impossible for a rational asset pricing model to forecast how the market will behave.

This study tests the weak-form efficiency of Arab stock markets after the COVID-19 epidemic. As far as the authors are aware, this is the first research to comprehensively examine the weak-form efficiency of the indices of all Arab stock markets after the COVID-19 pandemic.

The purpose of this study is to investigate the effect of the COVID-19 pandemic on the weak-form efficiency of Arab stock markets.

The study hypotheses are as follows:

H01: The indices of Arab stock markets follow a random walk.

H02: The indices of Arab stock markets are efficient in the weak form of the efficient market hypothesis.

H03: The price changes in indices of Arab stock markets are independent.

2. METHOD

The effect of the COVID-19 pandemic on the stock market efficiency of Arab countries is examined using the returns of the stock market indices of Jordan, Lebanon, Kuwait, Morocco, Oman, Palestine, Iraq, Qatar, Bahrain, Egypt, Saudi Arabia, United Arab Emirates, Syria, Tunisia, and Sudan. Daily data from July 1st, 2021 to November 12th, 2022 (370 trading days) are used. Before conducting the analysis, the Augmented Dicky-Fuller non-stationarity test is utilized to test the stationarity of the indices' returns. Thereafter, the variance ratio test (which is constructed by Lo and MacKinlay (1988) is employed to test whether the returns are predictable (indicating inefficiency) or not. It analyzes the predictableness of time series data by comparing the variances of differences of the data (returns) generated across various intervals. If it is proposed that the data follow a random walk, then the variance of a one-period difference should be doubled by the variance of a -period difference. The variance ratio test is based on assessing the empirical evidence for or against this constraint.

The variance of the random walk increments must be a linear function of a time interval (q) for the test to be valid, which is one of the random walk process's features. In other words, returns will exhibit random walk behavior when the variance of

the (qth) difference is equal to the (q) times variance of the first difference. This is how the VR Z-statistic is computed (Lo & MacKinlay, 1988):

$$Z(q) = \left(VR(q) - 1\right) \cdot \left(S^2(q)\right)^{-\frac{1}{2}}, \quad (1)$$

where (under the *i.i.d.* hypothesis)

$$S^2(q) = \frac{2(2q-1)\cdot(q-1)}{3qT}. \quad (2)$$

Along with the variance ratio test, the runs test is furthermore used in this study. The runs test could be used to test the market efficiency at the weak level by deciding if a data set follows a random process (Bradley, 1968). Determining the number of runs in the data sequence is the first step in the runs test. There are many methods to define runs, though, in all ways the construction should result in a dichotomous sequence of values. In this study, positive values will be classified as above the mean, and negative ones as below the mean. A sequence of successive positive (or negative) numbers is called a run. The runs test is given as:

H_0: *The sequence follows a random process.*

H_a: *The sequence does not follow a random process.*

The test statistic is:

$$Z = \frac{R - \bar{R}}{STD}, \quad (3)$$

where R is the observed number of runs, $\bar{R}$ is the expected number of runs, and STD is the standard deviation of the number of runs. The values of R and STD are calculated as follows:

$$\bar{R} = \frac{2N_1N_2}{N_1 + N_2} + 1. \quad (4)$$

$$STD = \left(\frac{2N_1N_2(2N_1N_2 - N_1 - N_2)}{(N_1 + N_2)^2(N_1 + N_2 - 1)} \right)^{0.5}, \quad (5)$$

where N_1 and N_2 denote the number of positive and negative values in the series, respectively.

Significance Level: α
Critical Region: The runs test rejects the null hypothesis if

$$|Z| > Z_{1-\alpha/2}. \quad (6)$$

For a large-sample runs test (where $N_1 > 10$ and $N_2 > 10$), the test statistic is compared to a standard normal table. Specifically, at the 5 % significance level, a test statistic with an absolute value greater than 1.96 indicates non-randomness.

Table 1. Major statistics of Arab stock exchanges

Source: Arab Federation of Capital Markets.

Markets	Volume traded in US dollars	Quantity traded in shares of stock	Market capitalization in US dollars	Number of contracts	Number of corporations
ABU DHABI SECURITIES MARKET	541.96	433	693,973.13	21000	62
AMMAN STOCK EXCHANGE	16.17	9.95	24,834.29	2760	164
BAHRAIN STOCK EXCHANGE	0.99	0.87	20,583.77	31	50
BEIRUT STOCK EXCHANGE	0.66	0.01	21,169.07	11	97
BOURSA KUWAIT	0	0	96,269.43	0	204
CASABLANCA STOCK EXCHANGE	9.61	0.62	50,688.78	649	76
DAMASCUS SECURITIES EXCHANGE	0.56	0.16	8,905.93	267	28
DOHA SECURITIES MARKET	0	0	138,721.65	0	49
DUBAI FINANCIAL MARKET	91.17	176	157,497.62	7209	119
EGYPT CAPITAL MARKET	20.73	515.72	12,435.03	53415	229
IRAQ STOCK MARKET	0	0	11.75	0	105
KHARTOUM STOCK EXCHANGE	0	0	3,758.37	0	66
MUSCAT SECURITIES MARKET	0	0	26,630.12	0	161
PALESTINE SECURITIES EXCHANGE	0	0	16	103	49
SAUDI STOCK MARKET	0	0	2,544,239.44	0	203
TUNIS STOCK EXCHANGE	0	0	8,911.30	0	79
Total	681.84	1,136.34	3,808,645.68	85,445	1741

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3. RESULTS

Table 1 shows the major statistics of Arab Stock markets. Statistics show that Egypt, Kuwait, and Saudi Arabia have the largest number of companies, respectively. The Saudi stock market has the largest market capitalization, followed by the Abu Dhabi Securities Market and the Dubai Financial Market. The daily trading statistics show that stock markets differ significantly; the Egypt capital market has the largest number of contracts and the largest number of shares traded, while the Abu Dhabi securities market shows the largest value traded.

Table 2 presents the descriptive statistics of the index returns of Arab countries over the study period. Statistics show that the daily mean return ranges from –0.0048 in the Khartoum Stock Exchange to 0.0013 in the Damascus Securities Market. The maximum and minimum daily return values differ widely between the different stock markets.

Table 3 shows the stationarity test values of daily index returns for Arab stock exchanges. The results show that index returns are stationary; thus, given the significant test value, the unit root is rejected.

Table 4 displays the variance ratio test values of daily index returns for Arab countries. The results of Boursa Kuwait, The Egyptian Exchange, Tadawul, and the Amman Stock Exchange show statistically significant values, which indicates rejecting the null hypothesis that the series is the martingale. These results indicate that returns are unpredictable in these stock exchanges; thus, the efficient weak form is evident. *H01, H02,* and *H03* are accepted for these stock markets. On the other hand, the variance ratio test is insignificant in other Arab stock exchanges, which indicates that returns are predictable and markets are inefficient at a weak level. *H01, H02,* and *H03* are rejected for these stock markets.

Table 4. Variance ratio test

Stock Exchange	Max |z| (at period 4)	
	Value	Prob
ABU DHABI SECURITIES MARKET	–1.5509	0.1209
AMMAN STOCK EXCHANGE	3.2704	0.0043
BAHRAIN STOCK EXCHANGE	1.0102	0.3124
BEIRUT STOCK EXCHANGE	1.1260	0.7004
BOURSA KUWAIT	4.4818	0.0000
CASABLANCA STOCK EXCHANGE	2.0409	0.1551
DAMASCUS SECURITIES EXCHANGE	1.4441	0.1487
DOHA SECURITIES MARKET	1.3663	0.1718
DUBAI FINANCIAL MARKE	1.1478	0.2510
EGYPT CAPITAL MARKET"	4.3992	0.0000
IRAQ STOCK MARKET	0.9935	0.3205
KHARTOUM STOCK EXCHANGE	0.9934	0.3205
MUSCAT SECURITIES MARKET	1.0681	0.2855
PALESTINE SECURITIES EXCHANGE	1.0299	0.3031
SAUDI STOCK MARKET	4.6656	0.0000
TUNIS STOCK EXCHANGE	1.0092	0.3129

Table 5 displays the values of the runs test of daily index returns for Arab countries. The results are similar to those using the variance ratio test. The

Table 2. Descriptive statistics of index returns for Arab countries

Stats	ADX	ASE	BAHRAIN	BAIRUT	KWAIT	CASABLANCA	DAMASCUS	DOHA
Mean	0.0001	0.0005	0.0000	0.0010	–0.0002	–0.0007	0.0013	0.0004
Med	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0009
Max	0.0588	0.0372	0.0437	0.0973	0.0240	0.0183	0.0311	0.0347
Min	–0.0609	–0.0301	–0.0828	–0.0671	–0.0392	–0.0947	–0.0349	–0.0352
Std. Dev.	0.0098	0.0071	0.0083	0.0160	0.0087	0.0078	0.0081	0.0103
Stats	DFM	EGYPT	IRAQ	KHARTOUM	MASQAT	PALISTINE	TADAWUL	TUNIS
Mean	–0.0001	0.0002	0.0006	–0.0048	0.0003	–0.0001	0.0000	0.0006
Med	0.0000	0.0017	0.0000	0.0000	–0.0001	0.0000	0.0000	0.0006
Max	0.0258	0.0472	0.1615	0.2284	0.0280	0.0869	0.0092	0.0118
Min	–0.0509	–0.0902	–0.1585	–2.3348	–0.0191	–0.0913	0.0000	–0.0098
Std. Dev	0.0088	0.0162	0.0158	0.1338	0.0057	0.0092	0.0005	0.0033

Table 3. Stationarity test

Group unit root test		
	Statistic	Prob.
Levin, Lin & Chu t	–66.3142	0

runs test statistic is statistically insignificant for the Egyptian Exchange, Tadawul, and the Amman Stock Exchange, confirming the randomness of the index return series of these stock exchanges, which in turn indicates the efficiency at the weak level. Other stock exchanges show statistically significant test values at (α = 5%), indicating that these exchanges' index return series do not follow a random walk and, consequently, they are inefficient at the weak level.

Table 5. Runs test

Stock Exchange	Value	Prob
ABU DHABI SECURITIES MARKET	115	0.0114
AMMAN STOCK EXCHANGE	134	0.4872
BAHRAIN STOCK EXCHANGE	125	0.0500
BEIRUT STOCK EXCHANGE	119	0.5800
BOURSA KUWAIT	115	0.0789
CASABLANCA STOCK EXCHANGE	112	0.7240
DAMASCUS SECURITIES EXCHANGE	118	0.6200
DOHA SECURITIES MARKET	122	0.3230
DUBAI FINANCIAL MARKET	136	0.1630
EGYPT CAPITAL MARKET	73	0.5841
IRAQ STOCK MARKET	21	0.7420
KHARTOUM STOCK EXCHANGE	91	0.1400
MUSCAT SECURITIES MARKET	87	0.1840
PALESTINE SECURITIES EXCHANGE	92	0.7500
SAUDI STOCK MARKET	13	0.9539
TUNIS STOCK EXCHANGE	45	0.9800

4. DISCUSSION

One of the key tenets of financial theory is the efficient market hypothesis. A market that is efficient is one in which a large number of rational participants actively compete with one another in an attempt to estimate the future market value of individual stock prices and where all relevant information is almost universally available to investors at no cost (Fama, 2021). In behavioral finance, it is commonly believed that events that cause general fear, such as conflicts, financial, political, and economic crises, recessions, shocks, crashes, exchange rate systems, and epidemics, often result in the deviation of asset prices from their underlying values, leading to the collapse of the efficient market hypothesis (Lalwani & Meshram, 2020; Charfeddine et al., 2018; Rahman et al., 2017; Charfeddine & Khediri, 2016; Verheyden et al., 2015; Khediri & Charfeddine, 2015; Charles et al., 2015; Rodriguez et al., 2014; Urquhart & Hudson, 2013; Lim et al., 2013; Kim et al., 2011). This study has focused on the effect of the COVID-19 pandemic on the Arab stock markets' weak-form efficiency. This form of efficiency indicates that stock prices should reflect all past (historical) information.

The findings of this study shed light on the variety of weak-form efficiency levels between Arab stock markets after the coronavirus pandemic. Egypt Capital Market, Saudi Stock Market, Amman Stock Exchange, and Boursa Kuwait are efficient at a weak level of efficiency, while other stock markets are not. Investors in inefficient markets may use previous data, including price history, to forecast future stock prices and make unexpected profits. Understanding the behavior of stock prices can help both investors and regulators to reach fair prices in stock exchanges. These findings are similar to previous studies (Ozkan, 2021; Singh et al., 2020; Lalwani & Meshram, 2020; Vasileiou, 2020), which show that most stock markets were inefficient during the pandemic, while they differ in efficiency in the after-pandemic era.

The results of this investigation will help in putting an economic foundation for crucial policy interferences. The study's conclusion is essential knowledge for every investor, whether they are operating in Arab countries or interacting with the countries' stock markets. Listed companies may find the results useful in understanding the real picture of their stock prices. What is done in this research article is to test stock exchanges in the Arab world only at the weak form of efficiency. However, future research could focus on both semi-strong and strong forms of efficiency specifically for the stock markets that are found to be efficient at the weak level of efficiency.

CONCLUSION

The weak-form market efficiency in the Arab stock markets of Jordan, Lebanon, Kuwait, Morocco, Oman, Palestine, Bahrain, Iraq, Qatar, Egypt, Saudi Arabia, the United Arab Emirates, Syria, Tunisia, and Sudan during the post-coronavirus pandemic era was examined in this paper. The results of the

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variance ratio test indicate that just four of them – the Egypt Capital Market, the Saudi Stock Market, the Amman Stock Exchange, and Boursa Kuwait – are efficient at the weak level. These stock markets' indices have independent price fluctuations and exhibit a random walk. Following the coronavirus epidemic, the other Arab stock markets do not appear to be weak-form efficient. The runs test of weak-form efficiency is used to validate these findings. Academicians and industry professionals involved in these marketplaces, such as regulators and investors, should take note of the results. Inefficient stock exchanges might allow investors to predict stock returns using previous trading data, and authorities should endeavor to preserve efficiency.

AUTHOR CONTRIBUTIONS

Conceptualization: Hanna Waleed Alrabadi, Naim Salameh Al-Qadi.
Data curation: Hanna Waleed Alrabadi, Naim Salameh Al-Qadi.
Formal analysis: Hanna Waleed Alrabadi, Naim Salameh Al-Qadi.
Funding acquisition: Hanna Waleed Alrabadi, Naim Salameh Al-Qadi.
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Writing – original draft: Hanna Waleed Alrabadi, Naim Salameh Al-Qadi.
Writing – review & editing: Hanna Waleed Alrabadi, Naim Salameh Al-Qadi.

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