Examining Sectoral and Macro Indices' Random-Walk Behavior on the Egyptian Stock Market

by

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Abstract

The Purpose: The study's objectives are to measure the long-term changes in the Egyptian financial market and determine how closely price changes in the primary and particular indicators of the Egyptian Stock Exchange adhere to the random walk hypothesis in order to assess the financial market's efficiency at the weakly efficient level.

Methodology: Using 4114 daily observations and monthly data for the closing prices of the main and qualitative indices from 1/3/2008 to 12/31/2024, tests such as the transformation test, variance test, unit root test, and correlation test were performed to gauge efficiency at the weak level. Sequential analysis of data yields findings.

Findings: The results of the study showed the lack of market efficiency requirements at the weak level in the Egyptian financial market, including the depth and breadth of the market, the speed of its response, the diversity of investments within it, and disclosure and governance. The structure of the Egyptian

financial market still needs developments in order to accommodate the overall economic reforms in Egypt.

Keywords: random walk - financial market efficiency - stock prices.

المستخلص

الغرض من الدراسة: اختبار عشوائية التغيرات السعرية لمؤشرات البورصة المصرية الرئيسية والنوعية لفرضية السير العشوائى للحكم على كفاءة السوق المالى عند المستوى ضعيف الكفاءة، كذلك لقياس التغير الذى طرأ على السوق المالية المصرية عبر الأجل الطويل.

المنهجية: تم استخدام بيانات شهرية لأسعار اغلاق المؤشرات الرئيسية والنوعية خلال الفترة من ٢٠٠٨/١/٣ وحتى ٢٠٢٤/١٢/٣١، بواقع ٤١١٤ مشاهدة يومية، وبإجراء اختبارات قياس الكفاءة عند المستوى الضعيف منها اختبار التحولات، واختبار التباين، واختبارات جذر الوحدة وإختبار الارتباط التسلسلى على بيانات الدراسة للحصول على النتائج.

النتائج: أظهرت نتائج الدراسة عدم توافر متطلبات كفاءة السوق عند المستوى الضعيف فى سوق المال المصرى، ومنها عمق السوق واتساعه وسرعة استجابته وتنوع الاستثمارات داخله والافصاح والحوكمة، ولازال بنية السوق المالية المصرية تحتاج لتطورات حتى تستوعب الاصلاحات الاقتصادية الكلية فى مصر.

الكلمات المفتاحية: السير العشوائى- كفاءة السوق المالى- أسعار الأسهم.

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Introduction:

One of the subjects that has generated a lot of discussion among interested parties, including scholars and practitioners, is the effectiveness of financial markets. In addition to the advent of research findings that support behavioral finance, this may be due to what some experimental investigations have called "Anomalies," such as the "Day-of-the-week effect," the "January effect," the "Holiday effect," the "Size effect," etc. However, the findings of empirical research bolstering efficiency hypotheses concurred that the characteristic that sets apart an efficient capital market is the random fluctuation of stock prices. It is challenging to foresee a certain pattern of price trends in the upcoming time frame under an efficient market. Furthermore, the fair value, which represents the performance of the facilities issuing the securities, is expressed in the pricing of those securities. (Srinivasan et al.,2023)

One technique for weakly testing market efficiency is the random-walk hypothesis. The market is deemed to be weakly efficient if prices exhibit the random walk feature, which indicates that market

participants are unable to use historical stock prices to predict current prices. Conversely, if investors are able to use historical prices to predict current and future prices through trading rules and achieve extraordinary profits, the market is deemed to be weakly efficient. (Dragota & Tilica, 2013).

In light of the aforementioned, the research's significance lies in its attempt to address two questions:

- Does the random walk hypothesis apply to the behavior of shares in the Egyptian market, both at the level of the entire market and in the qualitative sectors?

- In the long run, does the Egyptian market match the efficiency requirements?

The first section discusses the intellectual framework of the study; the second section covers the methodology and statistical techniques used; the third section presents the findings and recommendations; and the fourth section presents the results of the statistical analysis of the hypothesis tests.

(1) first section: The intellectual framework of the study:

The intellectual framework, the random behavior and market efficiency are dealt with: and the literature of previous studies is reviewed. The following is a brief description of these two elements:

1.1 Random behavior and market efficiency

Since stock prices fluctuate in response to new information entering the market and dealers' interpretations of it, the Efficient

Market Hypothesis (EMH) postulates that stock prices must react to new information promptly and precisely. When the likelihood that an investor's gains will be abnormally greater than market gains declines, market efficiency increases. (Riaz, et. al. 2022). Because all investors have full access to information at the same time and make logical decisions, Farma (1970) holds that efficient market prices reflect all available information and are those in which the market value of shares converges, to a large extent, with their fair or real value. The degree to which the prices of traded securities react to the information at hand is what determines the market.

It is important to note that the weak market efficiency test is also known as the random price movement test because current prices are unaffected by previous prices and because prices fluctuate in response to the random introduction of new information into the market. As a result, investors cannot anticipate a particular pattern in the direction of market price movements (Rabbani et al. 2023). As a result, it is anticipated that the stock's return at the end of period T will equal its return at the end of period T + 1.

$$R_t = R_{t+1}$$

The random walk model is based on two elements, as El-Said Ibrahim (1994) notes:

  - Independence in successive price changes.

- The probability distribution of securities returns over time periods is similar.

The random walk model can be expressed in the following form:

$$F (R(t+1) \text{ inf}) = F (R \text{ } t+1)$$

This means that the probability function for the distribution of the returns of the stock or index in the period is $1 + t$, and based on the current information (inf.), the probability function for the distribution of the returns in the period is equal to $T + 1$. That is, there are no differences between the probability distribution of stock returns based on current information with the probability distribution of stock returns that do not depend on the study and analysis of current information (Mohamed Abdo Mustafa 2011), (Al- Sayed A. Ibrahim 1994).

1.2 Literature review of previous studies:

The researcher discovered that stock prices exhibit random behavior and that the majority of experimental study results on developed markets satisfy the minimal standards for efficiency at the weak level after examining the results. As a result, research in those marketplaces typically looked at efficiency from a higher level (an analysis of the impact of private knowledge) (Ansari & Sapate 2011). As for the experimental studies conducted on emerging markets to test the hypothesis of random movement of prices, within the framework of the study of market efficiency in a weak way, the results varied, as we find studies that support the hypothesis of random movement. Examples of these studies

(Cheung & Coutts,2021) study on the Hong Kong Stock Exchange, Islam & Khaled's (2005) study on the Bangladeshi market, Lock's (2007) study on the Taiwanese market, Asiri's (2008) study on the Bahraini market

(Sharma & Mabendru's,2009) study in India and Metghaltchi & Chen's (2012) study on the Brazilian Market.

On the other hand, other studies do not support the random walk hypothesis, such as the study of Kian-ping, et al. (2008), which indicated that there is a significant impact of financial crises on the level of efficiency of six Asian markets (Hong Kong, the Philippines, Malaysia, Singapore, Thailand, and Korea. There is, also, Elango & Hussein's (2008) study on the markets of the Gulf Cooperation Council countries, Nader Alber's (2008) study on the Saudi stock market, Gupta & Yang's (2011) study on the Indian market, Nikita & Soekamo's (2012) study on Indonesian stock market, and the study of Zirvan Abdul Mohsen et. al. (2015) on the Iraqi market.

Other studies have indicated that there is a discrepancy in the levels of efficiency in emerging markets such as Sensor's (2013) study. It was conducted on the Middle East and North Africa markets (MENA stock markets), and its results indicated that there is a discrepancy in the levels of efficiency in those markets, in addition to the presence of negative effects of the Arab Spring Revolutions. This result was supported by the results of Thomas & Brian's (2008) study, which was conducted on the same

markets, and of Dragota & Tilica's (2013) study which was conducted on 20 stock markets in Eastern Europe (formerly Socialist countries).

At the level of the Egyptian market, There are scholarly investigations that focus on examining the degree of market efficiency and testing the premise of the random walk of stock prices. Early research evaluating the Egyptian stock market's efficiency and potential for growth is exemplified by Saeed Tawfiq's (1989) findings, which showed that the market is inefficient at a weak level.

In a study conducted by Khairy Al-Jaziri (1991) on 30 company shares distributed over 12 sectors during the period 1987-1990, the study indicated that stock prices in the Egyptian market were not characterized by random behavior, and that the Egyptian market was completely inefficient and could not be classified under any of the efficiency levels of financial markets.

El-Said Al- Badawi Ibrahim's study (1994) which was conducted on a sample of 30 shares of companies traded in the market during the period from January 11, 1994 to August 17, 1994, confirmed that the successive changes in stock prices do not follow the random path, that is, they are not independent. In another study by Khairy Al-Jaziri (1995) that applied to the same companies (an extended study during the period 1/1/1992-31/12/1995), it is indicated that there was no fundamental change in the level of market efficiency from the first study. Nabil

Shaker's (1998) study was conducted on the CASE30 index during the period 1/1/1997 to 31/3/1998, and it clarified that stock prices do not behave randomly, and therefore the Egyptian market is inefficient at the weak level.

The study of Yousra Khalifa and Sarah Sobhy (2012), which was conducted on the returns of the main stock index EGX30 during the period 2007-2010, indicated that there is a strong positive serial correlation between the returns of the index over the study period, and that the past returns play an influential role in predicting future returns.

Srinivasan et al.,(2024) study The growing volatility of virtual currencies raises a number of worries, even while cryptocurrency markets are expanding at an exceptional rate with continuously high trading volume and market capitalization. One of the main issues is (in)efficiency, namely whether there are chances to generate excess profits by outperforming the market or if it's just a matter of luck. The authors of this study use parametric and non-parametric random walk testing techniques that are resistant to asymmetric effects and unknown structural breaks to examine the weak-form efficiency of the top 10 cryptocurrencies. The results validate the weak-form inefficiency for daily cryptocurrency returns since they refute the random walk hypothesis. The existence of asymmetric volatility clusters is the cause of this. There are important ramifications for portfolio

managers from this study, market participants and regulators of leading cryptocurrency markets.

The expected contribution of the current study lies in its attempt to test the hypothesis of the random walk of the Egyptian stock market at the level of the market as a whole, as well as at the level of specific sectors in the market, in an attempt to study the efficiency of the Egyptian capital market at a weak level, and to find out the extent to which there are differences in the walk movement of prices between the qualitative sectors or with the main indicators of the market.

(2) second Section: The methodology of the study and the statistical methods used

2.1 The problem of the study: Since Saeed Tawfiq's study (1989), the majority of studies have shown that the Egyptian market did not reach the level of efficiency in a weak way, despite the framework of measuring market efficiency in the weak form and what prior research has shown in support of this form in developed markets, with a discrepancy in emerging markets. As one of the primary instruments for revealing the market's performance, the following chart illustrates the evolution of the overall degree of price movement in the Egyptian stock market and how it represents the general index of the market, EGX 30, from its launch on 3/1/2008 until 31/12/2024:

Figure (1)

Graph showing the evolution of the EGX30 index during the period 2010-2024

Source: created by the researcher using Eviews v.13 and the results of the statistical analysis

According to the preceding chart, the EGX 30 market index experienced violent fluctuations in its behavior from 2010 to 2021. This was caused by Egypt's experiences with economic and political instability, as well as the market's susceptibility to global financial crises during that time. The researcher emphasizes how crucial it is to examine price movement developments in order to determine the degree to which there are advantages or disadvantages to achieving a certain level of efficiency. Without a doubt, conducting longitudinal studies—a continual examination of the markets over an extended period of

time helps determine the degree to which efficiency has been attained. In addition to being aware of how implementing the laws and policies that were authorized and put into effect during the study period affected the degree of competence (Khairy Al-Jaziri 1995).

The following primary question can be addressed by formulating the study problem in light of the aforementioned:

2.1.1 To what degree do sectoral and macro-level Egyptian stock prices adhere to the hypothesis random walk?

It may be useful to divide the main question into two sub-questions as following:

2.1.2 If the qualitative and macro-level fluctuations in Egyptian stock prices are random, can the Egyptian stock market be regarded as an efficient market? To what extent has the market achieved efficiency?

2.2 The aim of the study: is to use the daily closing prices of the primary indices and qualitative sector indices from 3/1/2008 to 31/12/2024 to test the random walk hypothesis in the context of researching and evaluating the efficiency of Egyptian stock prices at the macro level and qualitative sectors.

To track the progress of the Egyptian stock market's attainment of a degree of efficiency from year to year (over time) between 3/1/2008, 31/12/2024, a temporal research measuring the changes that occurred in the market was also conducted.

2.3 Study Hypotheses: The study seeks to prove the validity of the following main hypotheses:

2.3.1 First hypothesis: Given that the Egyptian market is an efficient market at the weak level, the values of the primary index chains and qualitative sector indices are monitored throughout the study period in accordance with the random walk hypothesis.

2.3.2 second hypothesis: There are no variations in the Egyptian market's ability to achieve a certain degree of efficiency over time as a result of market events and developments

In order to quantify the market's overall efficiency and the efficiency of qualitative sectors in a weak manner, the researcher first aims to test the hypothesis of a random walk of stocks in the market. Regarding the second hypothesis, we aim to determine how the market was influenced to achieve a certain degree of efficiency by the events, reforms, and changes that occurred between 2008 and 2024.

2.4 The Importance of the study:

The importance of the study is due to:

2.4.1 Given that market efficiency is a key metric used by investors to guide their investments and construct their investment portfolios, the study's findings assist market management in diagnosing the degree of market efficiency, which aids in the development of plans, policies, and programs to increase the degree of operational and pricing efficiency in the

market. They also assist investors in formulating suitable investment strategies.

2.4.2 The study's significance also stems from its attempt to address a key query: Has the Egyptian stock market not yet descended into a state of low efficiency since the research of Saeed Tawfiq (1989) and Khairy Al-Jaziri (1995)? This answer aids in evaluating the actions and practices made to move the market in that direction.

2.5 Scope and data of the study:

Within the framework of the study of market efficiency at the weak level, the study focuses on testing the hypothesis of the random walk of Egyptian stocks at the macro and sectoral levels. The researcher used the primary indicators and qualitative sector indicators in the market from March 1, 2008, to December 31, 2024, with a total of 4114 daily observations, to accomplish this goal. The primary indicators for which information is available were chosen in accordance with the market's initial qualitative sector indicators, which were developed starting on 3/1 2008. As a result, EGX 30, EGX 70, and EGX 100 are the indices utilized in the main.

When it comes to qualitative sector indexes, the Egyptian Stock Exchange introduced 12 of them (avalaible datafor period) in an effort to help investors make better investment choices.

The website of the Egyptian stock market provided information on the values of the qualitative sector indexes and

the primary indicators, EGX30, EGX70, and EGX100..
(www.egx.com)

2.6 Statistical Methods Used

The researcher used the Shapiro-Walke and Kolmogorov-Siminov tests, two statistical techniques, to demonstrate the validity of the study hypotheses. They are regarded as non-parametric tests that confirm the time series' reliance on the research indicators of the normal distribution hypothesis.

2.6.1 Unit Root Test:

This Root Test, sometimes referred to as the Augmented Dickey-Fuller Test (ADF), is used to confirm that the study's time series indicators are stationary.

2.6.2 Runs Test: It sometimes referred to as the Relay or Randomness Test since it assesses how random or successive the behavior of the index values or returns is. Since the values or returns of the index series do not need to follow a normal distribution, this test is regarded as non-parametric.

2.6.3 Variance Ratio (VR): Lo & Makinal (1988) were among the first studies to use this test, suggesting that variance ratio might be used to address the heteroskedasticity issue that the self-correlation approach faces.

2.6.4 Autocorrelation or Serial Correlation Test: When checking for randomness in the behavior of time series data, one of the most popular parametric tests in experimental research. Within a time series of stocks or an index, the Autocorrelation

Test relies on the correlation coefficient between each return or value in the present period and the prior period.

(3)The third section: **statistical evaluation and hypothesis testing for the study:**

3.1 Examining how the research indicators' time series rely on the normal distribution: The Shapro-Walke and Kolmogrove-Semnov tests were employed by the researcher. Each test's statistical value and significance level are displayed in the following table.

Table (1)

Findings of the Kolmogrove- Semnov and Shapro- Walke normal distribution test

Main indices	Shapiro-Wilk Test		Kolmogorov-Smirnov test	
	Stat.	p-value	Stat.	p-value
EGX30	**0.756**	**0.00**	**0.076**	**0.00**
EGX70	**0.934**	**0.00**	**0.086**	**0.00**
EGX100	**0.942**	**0.00**	**0.078**	**0.00**
Sub- indices				
Banks	**0.934**	**0.00**	**0.087**	**0.00**
Resources	**0.957**	**0.00**	**0.098**	**0.00**
Chemicals	**0.837**	**0.00**	**0.145**	**0.00**
Construction	**0.835**	**0.00**	**0.152**	**0.00**
Non-Banking	**0.917**	**0.00**	**0.1764**	**0.00**
Foods	**0.957**	**0.00**	**0.113**	**0.00**
Healthcare	**0.937**	**0.00**	**0.1141**	**0.00**
Servies	**0.965**	**0.00**	**0.129**	**0.00**
Home	**0.866**	**0.00**	**0.012**	**0.00**
Realstat	**0.813**	**0.00**	**0.145**	**0.00**
Communication	**0.907**	**0.00**	**0.181**	**0.00**
Travel	**0.910**	**0.00**	**0.194**	**0.00**

Source: created by the researcher using Eviews v.13 and the results of the statistical analysis

All time series values of the EGX and sector indices in the Egyptian market do not match the hypothesis of normal distribution since the findings of the previous table show that the level of significance for the Kolmogrove-Semnov and Shabro-Walke tests is less than 1%.

Thus, in addition to the Unit Root test, the researcher employed other parametric tests like the Variance Ratio test and one of the non-parametric tests, the Runs Test, to quantify the random walk of stock movements in the Egyptian market. The researcher additionally employed the autocorrelation approach because of the high amount of readings (more than 200 observation).

3.2 First Hypothesis Test:

The researcher used the following statistical techniques to evaluate the viability of this hypothesis:

3.2.1 Runs Test:

At a significance level of 5%, the researcher employed the Runs Test, which is based on the arithmetic mean values of the returns of the twelve qualitative sector indices and the three EGX indices. The outcomes of the Runs Test of the study indicators are displayed in Table No. (2).

With the exception of the health sector indicator X7, the results show that the Z value's significance level is less than 5% for all indicators, including the primary indicators EGX and the qualitative sector indicators. This suggests that the null

hypothesis—that the indicator data is not random and that the behavior of stocks in the Egyptian market is not random—is accepted.

"When the values of the time series do not follow the hypothesis of the normal distribution and the volume of daily readings exceeds 200 readings, in that case the autocorrelation method can be used in the randomness test." (Abdul Al Hamid Al Abbasi 2011)

Table (2)
Results of Runs Test

Main indices	Z Stat.	p-value
EGX30	-5.6	0.00
EGX70	-4.1	0.00
EGX100	-5.3	0.00
Sub-indices		
Banks	-2.5	0.00
Resources	-4.7	0.00
Chemicals	-6.3	0.03
Construction	-3.5	0.00
Non-Banking	-5.2	0.00
Foods	-5.9	0.05
Healthcare	-.6	0.00
Servies	-5.2	0.00
Home	-3.6	0.00
Realstat	-6.8	0.01
Communication	-4.8	0.00
Travel	-5.3	0.00

Source: created by the researcher using Eviews v.13 and the results of the statistical analysis

3.2.2 Unit Root Test:

Since the level of significance of the T-Statistic values is less than 1% when taking the first differences (the difference between each two consecutive values in the original time series) without a linear and categorical trend, the results of Table No. (3), which is the result of the modified Dickey-Fluor ADF Test for the main

indicators and qualitative sector indicators, indicate the rejection of the null hypothesis, which means the presence of the unit root for all the main or sectoral indicators. This outcome indicates weak market inefficiency and the rejection of the hypothesis of the random walk of the study indicators.

Table (3)
Findings of Unit Root Test

Main indices	T. Stat.	p-value
EGX30	-37.453	0.00
EGX70	-37.112	0.00
EGX100	-38.334	0.00
Sub-indices		
Banks	-36.453	0.00
Resources	-37.981	0.00
Chemicals	-36.543	0.00
Construction	-38.452	0.00
Non-Banking	-36.543	0.00
Foods	-37.432	0.00
Healthcare	-36.008	0.00
Servies	-38.453	0.00
Home	-37.645	0.00
Realstat	-37.432	0.00
Communication	-36.464	0.00
Travel	-38.463	0.00

Source: created by the researcher using Eviews v.13 and the results of the statistical analysis

3.2.3 Variance Ratio Test: The variance ratio has been employed for various slowdown periods 2, 4, 8, and 16 in order to apply the Variance Ratio Test to the primary EGX indices and qualitative sector indices in the Egyptian market.

Table (4)
Findings of the Variance Ratio Test

Main indices	Values	Lags q			
		2	4	8	16
EGX30	Z.Stat.	-8.5	-8.3	-7.4	-5.8
	P-Value	0.00	0.00	0.00	0.00
EGX70	Z.Stat.	-9.3	-8.4	-7.2	-5.9
	P-Value	0.00	0.00	0.00	0.00
EGX100	Z.Stat.	-8.1	-8.4	-7.5	-5.9
	P-Value	0.00	0.00	0.00	0.00
Sub-indices					
Banks	Z.Stat.	-7.7	-7.2	-6.4	-5.6
	P-Value	0.00	0.00	0.00	0.00
Resources	Z.Stat.	-8.9	-7.6	-8.6	-7.7
	P-Value	0.00	0.00	0.00	0.00
Chemicals	Z.Stat.	-8.4	-8.8	-7.6	-7.1
	P-Value	0.00	0.00	0.00	0.00
Construction	Z.Stat.	-8.5	-8.6	-8.9	-6.4
	P-Value	0.00	0.00	0.00	0.00
Non-Banking	Z.Stat.	-9.8	-8.2	-9.0	-9.5
	P-Value	0.00	0.00	0.00	0.00
Foods	Z.Stat.	-7.6	-8.1	-7.9	-7.1
	P-Value	0.00	0.00	0.00	0.00
Healthcare	Z.Stat.	-1.2	-1.5	-1.5	-1.0
	P-Value	0.00	0.00	0.00	0.00
Servies	Z.Stat.	-5.4	-5.9	-4.7	-3.7
	P-Value	0.00	0.00	0.00	0.00
Home	Z.Stat.	-5.8	-5.9	-6.4	-6.1
	P-Value	0.00	0.00	0.00	0.00
Realstat	Z.Stat.	-1.3	-1.5	-1.1	-1.0
	P-Value	0.00	0.00	0.00	0.00
Communication	Z.Stat.	-4.3	-4.9	-3.4	-3.4
	P-Value	0.00	0.00	0.00	0.00
Travel	Z.Stat.	-5.3	-4.3	-5.5	-3.6
	P-Value	0.00	0.00	0.00	0.00

Source: created by the researcher using Eviews v.13 and the results of the statistical analysis

Tabular value of Z at a significant level of 1% = + 2.57

Since the level of significance for Z. Stat. values is less than 5% for all indicator series and for various slowing periods (with

the exception of the health sector index X7 and the real estate sector index X10), it is evident from the previous table that the Z. Stat. values decrease with increasing periods of slowdowns for all indicators. This indicates that the Z. Stat. values are heterogeneous and do not follow the hypothesis of random walk during the study period.

3.2.4 Autocorrelation (Serial Autocorrelation)Test

Slowing periods 1, 2, 3, and 16 were examined for the returns of the EGX and market sector indices as indicated in Appendix No. (1) in order to test the random walk hypothesis of the Egyptian market using the Autocorrelation Test. The results show significant values as the Box-ljung stat values at a significant level of 5% (with the exception of the real estate sector X10 and the banking sector X1 for slow periods 10, 16). This suggests that there is a serial correlation between the returns of the indices during the various slow periods, and, as a result, the random walk hypothesis was rejected during the study period. As demonstrated by the results of the Unit Root, Runs, Variance Ratio, Kolmogrove-Simnov, and Shabro-Wallke tests, the Autocorrelation test yielded consistently positive results. by disproving the theories of weak market inefficiency and the random walk of stocks in the Egyptian market.

3.3 Second hypothesis test:

The researcher used the following statistical techniques to assess the hypothesis's validity:

3.3.1 Runs Test

The following table displays the results of the Runs Test, which was employed by the researcher based on the arithmetic mean and median values of the indicator for each year separately and for all years combined between 3/1/2008 and 31/12/2024.

Table (5)

Findings of Run Test for the EGX30 indicator during the period 3/1/2008- 31/12/2024

years	mean		median		Observ.
	Z Stat.	P-Value	Z Stat.	P-Value	
2008	-15.3	0.00	-15.1	0.00	248
2009	-13.7	0.00	-13.4	0.00	247
2010	-15.9	0.00	-15.7	0.00	249
2011	-14.2	0.00	-14.8	0.00	247
2012	-13.5	0.00	-13.4	0.00	246
2013	-15.1	0.00	-15.6	0.00	245
2014	-13.2	0.00	-13.8	0.00	246
2015	-14.9	0.00	-14.1	0.00	244
2016	-15.3	0.00	-15.6	0.00	244
2017	-14.9	0.00	-14.7	0.00	247
2018	-14.7	0.00	-14.3	0.00	249
2019	-13.4	0.00	-13.2	0.00	247
2020	-14.7	0.00	-14.8	0.00	247
2021	-15.2	0.00	-15.1	0.00	247
2022	-15.3	0.00	-15.7	0.00	248
2023	-14.7	0.00	-14.9	0.00	249
2024	-14.2	0.00	-14.3	0.00	243
Total priod					4193

Source: created by the researcher using Eviews v.13 and the results of the statistical analysis

The previous table's results show that the level of significance for the value of Z is less than 1% for each year separately and for the years as a whole, whether based on the arithmetic mean or

median values. This suggests that the null hypothesis—that the EGX 30 index's values are not random—is accepted, and the Egyptian stock market does not meet the market efficiency requirements as weakly on the level of each year separately as well as on the level of all years using the Runs Test based on the values of the arithmetic mean and the median.

3.3.2 Variance Ratio Test

For the multiples of sluggish periods 2, 4, 8, and 16 during the period 3/1/2008 - 31/12/2024, the researcher employed the Variance Ratio Test for each year separately and for the entire set of years.

Table (6)
Findings of Ratio Test for the EGX30 indicator during the period3/1/2008 - 31/12/2024

years	Z Stat.		P-Value
	value	Lags	
2008	3.77	4	0.00
2009	3.23	٨	0.00
2010	2.34	٢	0.01
2011	3.45	١٦	0.01
2012	3.34	٢	0.03
2013	.82	٢	0.78
2014	2.6	٢	0.12
2015	1.43	٨	0.16
2016	1.45	٨	0.23
2017	2.54	٢	0.32
2018	2.86	٢	0.154
2019	3.74	١٦	0.028
2020	3.91	٤	0.25
2021	2.54	٢	0.25
2022	1.43	٤	0.14
2023	1.65	٤	0.035
2024	2.54	١٦	0.02
Total priod	2.51	٤	0.00

Source: created by the researcher using Eviews v.13 and the results of the statistical analysis

Based on the preceding table and the Z. Stat level of significance, the null hypothesis—that the indicator series is homogeneous in variance and follows a random walk—is accepted for the years 2012–2018 and 2020–2022. For the remaining years, however, the null hypothesis is rejected and the alternative hypothesis—that the indicator series is heterogeneous and does not follow the random walk—is accepted.

As for the years as a whole, the results of the Variance Ratio Test showed acceptance of the alternative hypothesis that the series of index values during that period (3/1/2008 - 31/12/2024) is heterogeneous and does not follow the random walk hypothesis.

3.3.3 (Serial) Autocorrelation Test

Slow phases 1, 2, 3,...., 16 periods of slowing down the indicator values were taken in order to test the Random Walk hypothesis of the EGX30 index during the study period using the Autocorrelation Test.

According to the data, the EGX30 index series values for the various slow periods during the study period show self-correlation. The hypothesis of random walk and market inefficiency of the Egyptian market in its weakest form is rejected for each year separately as well as for the years as a whole, with significant Chi-square values of the Box-Ljung Test at a significant level of 1%.

This outcome is consistent with the findings of the Variance Ratio Test and the Runs Test, which use the arithmetic mean and median values.

(4) Section Four: Results of the Study and Suggestions

4.1 Random walk hypothesis test results: Using the daily closing prices of the study indicators from March 1, 2007, to August 28, 2014, the random walk hypothesis of the Egyptian stock market was tested within the framework of the study of the market's weak form efficiency at the macro level and qualitative sectors. Kolmogrove-Mmenov's Choice, Shabro-Walke, Root Unit Test, Variance Test (based on the arithmetic mean values), Variance Ratio Test (with slow periods of 2, 4, 8, 16), and Autocorrelation Test (with slow periods of 1, 2,... 16) are examples of parametric and non-parametric tests that are used in this process.

Whether at the macro level (EGX30, EGX70, and EGX100 indices) or at the level of qualitative sector indices (with the exception of the contracting sector index and the health and medicine sector index), the results of all tests point to rejecting the random walk hypothesis of share movement in the Egyptian stock market and, consequently, market efficiency in weak form during the study period. The findings of the Variance Ratio Test and the Variance Test based on the arithmetic mean values have shown that there is randomness in both the data of the contracting sector index and the data of the health and medicine index. It is

important to note that, despite the absence of comparable traits, the contracting and health and medicine sectors achieve the best results and randomness in price movements. This can be attributed to the expansion and growth of their respective activities and works as well as their unique features in the Egyptian market.

4.2 The following are the findings of the time study used to gauge the shift in market efficiency:

Three statistical tests were performed to measure market efficiency in a weak manner over time, at the level of each year separately as well as at the level of the entire study period, in order to determine the impact of the various developments and reforms that the market witnessed during the period from 3/1/2008 to 31/12/2024 on pushing the market to reach a level of efficiency. The Variance Test, which was based on the arithmetic mean and median values, and the Ratio of Variance Test for Slow Periods 2, 4, 8, and 16 were examples of statistical approaches. Test of Autocorrelation for Slow Periods 1, 2,... 16.

The hypothesis of the random walk of stock movements at the level of the entire study period was rejected by the findings of the three tests, which showed that the Egyptian market did not achieve the weak form. The Variance Test results only differed from year to year at the level of each individual year.

Consequently, the Egyptian stock market's level of efficiency has remained constant throughout the last 18 years, from 1998 to 2015. Maybe that clarifies

the lack of any favorable outcome from the implementation of reform procedures and policies—sufficiently—during that time frame to drive the market toward efficiency.

4.3 We can examine and discuss about the following using the earlier findings:

4.3.1 The findings of this study are consistent with all experimental findings that refute the theory that stock price fluctuations in emerging markets follow a random walk due to a lack of market efficiency requirements in their weak form (previous experimental studies explained in Literary review of studies in this search).

4.3.2 Up until the findings of the current study, the requirements for the Egyptian market's efficiency have been unavailable in a weak form since the research of Saeed Tawfiq (1989), El-Said Al-Badawi Ibrahim (1994), etc. This suggests that the criteria for trading efficiency, market depth, market breath, resilience, investment diversification, and transparency are not being fulfilled. The money market did not fully comprehend the reforms and privatization initiatives that were put into place, as well as the significant market events that occurred throughout the research period.

4.3.3 The study's findings provided insight into the investor's behavioral interpretations, information-use skills, and judgment in timing transactions. According to a study by Peter et al. (2008), investors' stock prices exhibit behavioral variability as a result of social and behavioral variables. This certainly confirms the findings of behavioral finance research.

4.3.4 Suhair Thabet Ahmed's (2013) study on the Egyptian market, which focused on the lack of independence and predictability of successive changes in stock prices in the market as well as the possibility of predicting the future, supports the study's findings. The study also highlights the significance of technical analysts in the Egyptian market because they can use technical rule strategies to achieve extraordinary profits that surpass the strategy of buying and holding.

4.3.5 Based on analyzing historical stock price trends to forecast future price movements, the study's findings suggest that the Egyptian market has the potential for spectacular returns. This is regarded as a denial of both the lack of independence of price fluctuations in the Egyptian market and the random walk hypothesis.

4.4 The researcher suggests the following in light of the earlier findings:

4.4.1 Market mechanisms that ensure all dealers have simultaneous access to information should be provided by the stock exchange management. The announcement must be

delivered in a manner that accommodates the various investor types and traits while preventing any chance for investors to achieve exceptional market gains.

4.4.2 In order to help investors perform appropriate financial analysis and evaluation and determine the security's fair value, it is necessary for market-registered companies to be open and honest about information that influences the price trends of their securities in the market. This includes releasing lists of business results and supplementary clarifications.

4.4.3 the significance of the variety of financial institutions for evaluating financial metrics and business performance in order to guide investors toward logical decision-making. In order to provide investors with financial services that are accurate, impartial, comprehensive, and timely, these institutions are primarily responsible for extrapolating all current and future financial and economic conditions at the state and market levels. This causes rumors, group buying or selling, the herd method, etc., to fade, which has a negative impact on market efficiency.

4.4.4 In order to create a large pool of investors who satisfy the needs of effective trading and boosting market liquidity, more shares will be listed in the market by encouraging businesses to list their papers there and by attempting to draw in indirect foreign investments.

4.4.5 Empirical studies on market efficiency assumptions are being conducted more frequently in the Egyptian market,

particularly in relation to investor rationality and portfolio creation skills.

4.5 Additionally, the researcher suggests carrying out research in the following fields:

4.5.1 The random walk hypothesis is evaluated on the shares of companies whose shares are traded on the market using the same statistical techniques that are used to confirm randomness at the company level.

4.5.2 evaluating the risks and rewards of investing in Egypt in contrast to developing nations.

4.5.3 investigating the connection between market efficiency and governance concepts and procedures.

4.5.4 event studies to determine the influence on market trading movement.

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