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Inflation Hedge Abilities of Stock Returns Compared to Government Debt Securities in Egypt: *Evidence from ARDL and NARDL Frameworks*[1]

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ABSTRACT

This study aims to investigate the inflation hedge abilities of Egyptian stock market returns compared to the returns of treasury bills and government bonds in Egypt. To achieve this, monthly data from March 2011 to December 2023 were employed in linear and nonlinear autoregressive distributed lag (ARDL& NARDL) frameworks. In the long run, the study results show a positive, symmetrical relationship between positive and negative shocks in the inflation rates and the returns of stock market indices, treasury bills, and government bonds. In the short run, the findings indicate negative effects of inflation rise shocks on stock and T-bill returns, while G-bond returns are not significantly affected. These results suggest that in the long run, the Egyptian stock market returns can be considered a safe haven and can provide good hedging against inflation risks as various Egyptian government fixed-income debt securities. The results of this study have significant implications for investors, as they can consider Egyptian stocks in their portfolios as effectively inflation-hedging assets on the long-term horizon, even during periods of sharp fluctuations in inflation rates. Additionally, some important implications for policymakers are derived from the study's findings of securities inflation hedging in the short run.

Keywords: *Stocks, Treasury bills, Government bonds, Inflation, Hedging, Egypt, Emerging market, ARDL, NARDL.*

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1. INTRODUCTION

Inflation can cause a decrease in the purchasing power of people's money, leading to a reduction in their living standards. Therefore, hedging against inflation is an important element when investors decide to invest in long- and short-term securities. For investors to successfully hedge against inflation and maintain their purchasing power in real terms, any investment must achieve higher returns or at least the same rate as inflation. Although this important hedging against inflation may be more apparent in periods of high inflation, a long-term investor needs to buffer the portfolio's real returns against the impact of any increase in price levels even in the absence of high inflation. Many investors use various securities to mitigate the risks associated with inflation (Spierdijk & Umar, 2015 & Aktürk, 2016).

In recent years, the world has faced major crises including the COVID-19 pandemic, the Russian-Ukrainian war, and supply chain disruptions. These crises have led to severe economic downturns for many countries due to the increase in energy and food prices. All countries, both major and emerging, have been impacted to varying degrees and are now facing significant repercussions, including a rise in inflation rates. In the Arab region, many countries have also suffered the negative effects of these global crises on their economies, particularly the non-oil Arab countries.

Egypt is one of the non-oil Arab countries. Egyptian economic activity has been negatively impacted by successive global shocks and limited domestic supply causing a foreign exchange crisis and high inflation rates (World Bank, 2023). Annual inflation rates have risen significantly over the past years, from 10.7% in January 2011 to 33.7% in December 2023 (Egyptian Central Bank, 2024). During that period, there were many fluctuations in inflation rates, with different periods of both increases and decreases. Over the periods that witnessed rises in inflation levels, the Egyptian government took many procedures to reduce these higher inflation rates including raising interest rates. Raising interest rates could allow debt instruments to confront high inflation rates and hedge their risks by increasing interest on those debt securities. As for equity securities like stocks, which are not directly linked to interest rates, they may not achieve the required hedge against inflation risk. Given the importance for investors to preserve their wealth, especially during periods of high inflation rates and its negative impact on real economic activity in the long term, local and international investors need to know how an emerging stock market like Egypt is performing during higher inflation periods, and whether they can provide them with a good hedge against inflation risks compared to fixed income securities or not.

The purpose of this study is to examine how inflation rate shocks influence the Egyptian stock market indices, in comparison to Egyptian treasury bills (T-bills) and Egyptian government bonds (G-bonds). During the years 2011 to 2023, which witnessed significant changes in inflation rates in Egypt, this study aims to determine whether returns on the Egyptian stock market can provide a good hedge against rising inflation rates, same as the returns on long and short-term fixed-income debt securities. By utilizing the linear and nonlinear autoregressive distributed lag (ARDL& NARDL) models, this study seeks to detect the long and short-run relation between inflation rates and securities return and determine the symmetry or asymmetry effects of the positive and negative inflation shocks on these securities. With this research, investors and policymakers can get valuable information about the ability of the Egyptian stock market to hedge against inflation shocks compared to government debt instruments during times of fundamental and severe shifts in inflation rates. Additionally, this study will offer insights into the short-term and long-term relationship between inflation changes in the Egyptian economy and returns on different types of Egyptian securities. It will also contribute to the literature by providing new evidence on the issue of securities inflation hedging abilities from the perspective of emerging markets like Egypt, which are exposed to significant changes in inflation rates. Developed markets have been the primary focus of previous studies on this topic, and thus, this research will fill an important gap in the literature.

The remainder of this paper is organized as follows. Section 2, includes a literature review of Ficher's hypothesis and inflation hedging abilities of stocks, T-bills, and government bonds, followed by the study hypothesis development. The data description and the methodology are discussed in section 3, while section 4 analyzes the study results about the inflation hedging abilities of different securities. Finally, section 5 includes the conclusion and the study implications.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Theoretical foundation and conceptual framework

Fisher (1930) proposed an assumption that the nominal interest rate on risk-free bonds over a specified period is equal to the sum of the expected real interest rate and the expected inflation rate during the same period. This hypothesis is known as 'the Fisher effect' in economic literature. According to this hypothesis, the nominal interest rate will move in parallel with expected inflation (Spierdijk & Umar, 2015). Fisher's hypothesis indicates that inflation and the nominal return on assets will change by the same values and direction, so the real return on securities remains constant and does not decrease because of higher inflation rates (Alqaralleh, 2020). The inflation-hedge securities eliminate the possibility that the real return on the security will become negative with the higher inflation rates (Bodie, 1976). Applying this assumption to different kinds of securities, the relationship between securities' nominal returns and the inflation rate will be positive. A positive relation between security returns and the inflation rate implies that security returns compensate for the rising inflation rate, making the securities a good hedge against the risks of high inflation (Bodie, 1976; Aktürk, 2016 & Yeap and Lean, 2017).

Fama and Schwert (1977) examined the validity of the Fisher hypothesis in explaining the relationship between inflation and equity returns. They found that common stock returns were negatively related to both the expected and unexpected components of the inflation rate. Fama (1981) attributed this inflation's negative effect on stock returns as the consequence of the proxy effect. The proxy effect means that stock returns are not directly determined by inflation but by expectations of other real activities, and the negative relationship between stock returns and inflation rates is a result of the negative relationship between inflation and real economic activities. This negative relation between security returns and the inflation rate implies that security returns cannot hedge against the risks of high inflation.

Through the following parts, the study discusses the previous studies that have analyzed the validity of the Fisher or the Fama hypothesis in explaining the relationship between the inflation rate and the returns of stocks, T-bills, and bonds.

2.2 Association between stock returns and inflation rate

Stocks are among the most studied assets to determine their ability to hedge against inflation. However, studies that examine the relationship between stock returns and inflation have produced mixed results that are not consistent. Some studies have supported Fisher's hypothesis that the coefficient of the relationship between stock returns and inflation is positive, indicating that stocks are a good hedge against inflation (Gultekin, 1983; Boudoukh and Richardson, 1993; Lee et al., 2000; Ali and Wahid, 2019, Salisu et al., 2020 & Huu-Dung, 2024). On the other hand, earlier studies in the US markets demonstrated a negative relationship between stock returns and inflation (Lintner, 1975; Bodie, 1976; Nelson, 1976 & Fama and Schwert, 1977) Mandelker and Tandon (1985) supported Fama's proxy effect hypothesis about the negative relationship between inflation and real activity, and a positive relation between real stock returns and real activity variables in six major industrialized countries. Kaul (1987) attributed the negative relationship between stock returns and inflation to money demand and countercyclical money supply effects. Many other empirical studies have also supported Fama's hypothesis that common stocks are not a good hedge against inflation and that inflation may be a proxy for a set of real variables (Cohn and Lessard, 1981; Solnik, 1983; Davis and Kutan, 2003; Eldomiaty et al., 2019 & Chiang and Chen, 2023).

Madadpour and Asgari (2019) argued that most studies that proved the negative relation between stock returns and inflation had primarily focused on developed and low-inflation economies. Therefore, it is essential to differentiate between the results of developed and developing countries as well as low- and high-inflation economies. Alqaralleh (2020) explained that the validity of Fisher’s hypothesis or Fama’s hypothesis should not be separated from the inflationary regimes or the position of the economic cycle in the market. Barnes et al. (1999) found that there was either a negative correlation or no correlation between inflation and nominal stock returns in all low- to moderate-inflation economies that they studied. Conversely, in high-inflation economies, there was a strong positive correlation between inflation and nominal returns. Additionally, Choudhry (2001) provided evidence of a positive relationship between current stock market returns and inflation in four Latin and Central American high-inflation countries. The stock returns acted as a hedge against inflation in these high-inflation countries. Spyrou (2004) conducted a study on ten emerging stock markets and discovered a positive correlation between expected inflation and stock returns in five Asian developing economies and four Latin American countries. In the US market, Spierdijk and Umar (2015) discovered that stocks did not have any hedging ability until the financial crisis of 2008. After the crisis, stocks developed significant hedging ability. Liu and Serletis (2022) conducted a study on the G7 and EM7 economies and discovered that the effects of inflation and inflation uncertainty on equity returns differ across countries based on changes in policy regimes, country-specific factors, and economic shocks across those countries. Connolly et al. (2022) demonstrated that the positive relationship between stock returns and inflation shocks only occurs during weaker economic times, while in stronger economic times this relationship is usually smaller and negative. Bouri et al. (2023) analyzed the co-movement between changes in expected inflation and U.S. stock sector returns and found a positive correlation between them since COVID-19.

On the other hand, some studies have shown the importance of distinguishing between the short-term and long-term ability of stocks to hedge against inflation shocks. Alagidede and Panagiotidis (2010) used a cointegration test in some African stock markets and found that in Egypt and South Africa stock markets, the response of stock prices to innovations in consumer prices showed a short-term negative response, which became positive over longer horizons. In other studies, conducted by Akmal (2007), Rushdi et al. (2012), and Ibrahim and Agbaje (2013) in different countries, the ARDL cointegration test, provided evidence that stock returns constitute a hedge against inflation in the long term but not in the short term. Al-Nassar and Bhatti (2019) also used the ARDL test in twenty-eight emerging countries and found that stock prices provide a good hedge against inflation, in more than a third of the examined cases, in the long run. Lee and Isa (2019) conducted a study that compared Malaysian stocks with other assets to determine their ability to hedge against inflation. Using the ARDL test, they found that stocks can provide a complete hedge against inflation in the long term. Magweva and Sibanda (2020) used the panel ARDL to evaluate the infrastructure stock sector in emerging markets and discovered the inability of infrastructure sector returns to hedge inflation in both the short and long run. Alqaralleh (2020) conducted a study on the G7 countries to investigate the asymmetric cointegration relation of stock returns with positive and negative inflation changes. The study relied on the NARDL test and found that inflation shocks have negative and asymmetric effects on stock returns in both the short and long run. The study also suggested that the downward phase of the economic cycle tends to reduce stock returns more than the upward phase. Furthermore, Sia et al. (2023) also employed a NARDL test and showed that inflation has a long-run and short-run asymmetric effect on Indonesian stock prices. Both positive and negative inflation changes harm the stock prices in Indonesia.

Previous studies examining the association between stock returns and inflation rates have shown that the validity of Fisher's hypothesis or Fama's hypothesis in explaining this relationship varies depending on several factors. These factors include the type of securities, the economic conditions of the countries studied, the study period, the measurement methods used, and the long or short-term effects of inflation on securities. The studies that examined the symmetric effects of positive and negative inflation shocks on stock returns (e.g., Alqaralleh, 2020 & Sia et al., 2023) revealed that positive and negative inflation shocks have asymmetric negative effects on stock returns in both the short and long run. However, these studies were conducted during periods that did not include significant changes in inflation rates. Other studies that examined the relationship between stock returns and inflation during periods of crises and economic shocks (e.g., Spierdijk and Umar, 2015; Connolly et al., 2022 & Bouri et al., 2023) found that the relationship turned positive during these periods, which witnessed significant changes in inflation rates. This suggests that during times of fundamental and severe changes in the inflation rate in Egypt, the effects of positive and negative inflation shocks on stock returns are positive and symmetric in both the short and long run. Therefore, the first research hypothesis is established as follows:

H1: There is a significant positive symmetric relationship between the positive and negative inflation shocks and the returns of Egyptian stocks in the long and short run.

2.3 Association between returns of treasury bills and inflation rate

Compared to stocks, studies that examined the hedging ability of treasury bills against inflation are few and limited. In the US market, Fama and Schwert (1977) proved that US government bills provided complete hedging against expected inflation. Trevino and Yates (2010) found that Treasury bill returns were highly correlated with inflation levels and performed better than bonds and stocks in periods of very high inflation. Washer and Dunham (2012) indicated that during high inflation periods in the US, T-bills and gold were the best hedge assets compared to other assets studied. Spierdijk and Umar (2015) tested the effectiveness of different types of securities and concluded that 3-month US government T-bills were effective long-term hedging against inflation during low or high macroeconomic volatility years. In Malaysia, a developing country, Lee and Isa (2019) used the ARDL cointegration test to show that government treasury bills were not cointegrated and could not hedge against inflation.

Previous studies examining the association between T-bill returns and inflation rates have provided mixed results regarding the effectiveness of T-bill returns in hedging against inflation. Although some studies (e.g., Trevino and Yates, 2010 & Washer and Dunham, 2012) indicated that T-bills were the best inflation hedging during high inflation periods, none of the T-bill's studies have tested the long and short-run asymmetric impact of positive and negative inflation shocks on T-bills. The overall conclusion is that there is ambiguity about the long and short-run symmetric effects of positive and negative inflation shocks on T-bills. Despite this ambiguity and based on previous studies that found a positive relationship between T-bills and inflation during high inflation periods, the study anticipates that during times of high inflation in Egypt, the impact of both positive and negative inflation shocks on T-bill returns will be positive and symmetrical in both the short and long run. As a result, the second research hypothesis is formulated as follows:

H2: There is a significant positive symmetric relationship between the positive and negative inflation shocks and the returns of Egyptian treasury bills in the long and short run.

2.4 Association between returns of bonds and inflation rate

Fama and Schwert (1977) proved that bonds in the US provided complete hedging against expected inflation. Woodward (1992) supported the validity of the Fisher effect and hedging ability for U.K. Indexed Bonds. Spierdijk and Umar (2015) tested the effectiveness of different types of US bonds and found that US bonds were not effective in inflation hedging during the sample period. Trevino and Yates (2010) found that bonds were adversely affected by increases in inflation. In Kenya, a developing country, Ngaruiya and Njuguna (2016) discovered that inflation had a significant negative relationship with bond prices in a low inflation period. In Malaysia, Lee and Isa (2019) used the ARDL cointegration test to show that treasury bonds were cointegrated and could hedge against inflation.

Previous studies examining the association between bond returns and inflation rates have provided mixed results regarding the relation between bonds and inflation. Despite some studies (e.g., Fama and Schwert, 1977& Lee and Isa, 2019) that found bonds provided complete hedging against inflation, none of the bonds' studies have tested the symmetric impact of positive and negative inflation shocks on bonds in the long and short run. Thus, the conclusion is that there is ambiguity about the long and short-run symmetric effects of positive and negative inflation shocks on bonds. With this ambiguity, the study can, nevertheless, make some anticipations that during times of significant changes in the inflation rate in Egypt, the impact of both positive and negative inflation shocks on G-bonds returns will be positive and symmetrical in both the short and long run. As a result, the second research hypothesis is formulated as follows:

H3: There is a significant positive symmetric relationship between the positive and negative inflation shocks and the returns of Egyptian government bonds in the long and short run.

Overall, previous studies on stocks, T-bills and bonds revealed that Fisher's hypothesis or Fama's hypothesis, which explains the relationship between inflation and securities return, varies depending on several factors like type of securities, the economic conditions, countries studied, the study period and the measurement methods used. This indicates the importance of studying different inflationary effects on securities return to make rational investment decisions in different circumstances and countries. Previous studies provided mixed results regarding the effectiveness of securities returns in hedging against inflation. Most of these studies overlooked the symmetric or asymmetric impact of positive and negative inflation shocks on various securities. While a few studies analyzed the asymmetric relations between stock returns and positive and negative inflation shocks, they have their limitations. These limitations pertain to their focus on advanced economies or during periods without any significant shift in inflation rates. Additionally, most of these studies concentrate on only stock returns, and none of them examine the asymmetric long-run and short-run inflation effects on T-bills and bonds returns. Thus, the issues of the asymmetric long-run and short-run inflation effects on different securities returns and the ability of these securities to hedge against inflation during periods of rising and falling inflation rates remain unanswered.

To address this gap, this study expands and improves the prior studies by analyzing the inflation hedge abilities of stock returns in comparison to different types of government T-bills and G-bonds returns in Egypt. Using the ARDL and NARDL frameworks, the study can identify the short and long-term inflation hedge abilities of securities returns and the asymmetric effects of positive and negative inflation shocks on these securities during times of fundamental and severe shifts in inflation rates in Egypt as an emerging country.

3. DATA AND METHODOLOGY

3.1 Data

This study analyzes monthly time series data from January 2011 to December 2023, comprising 156 observations, for the Egyptian inflation rate, stock market prices, T-bills prices, and G-bonds prices. The studied period chosen is during significant increases and decreases in Egypt's inflation rates. Monthly percentage changes in the Egyptian consumer price index (CPI) are used as monthly inflation rates. To assess the ability of various stock portfolio types to protect against inflation, the study uses stock market indices as proxies for Egyptian stock portfolios instead of individual stocks. This choice is made because market indices provide a more accurate representation of overall stock returns and volatilities. Additionally, market indices are diversified portfolios that help to eliminate specific risks associated with individual stocks. The study selects a sample of EGX indices based on their ability to effectively reflect the movements of the EGX, to generalize the results to the whole market. To ensure this, the study only includes stock indices that do not contain any inactive stocks, and whose listed companies are homogeneous. Under these conditions, the study utilizes monthly prices from three Egyptian Exchange (EGX) indices. The first index is the EGX30, which consists of the top thirty companies in terms of liquidity and activity. The second one is the Hermes Financial Index (HFI), which only includes companies with genuine liquidity in the EGX and excludes those that are traded sporadically. Lastly, the Egypt Financial Group Index (EFGI) contains large-cap and most actively traded companies in the EGX, with higher weights given to larger companies. To measure the inflation hedging abilities for different T-bill investment horizons, I use the closing monthly prices for the 91, 182, and 364-day T-bills. Finally, to investigate the inflation hedging abilities for different G-bond investment horizons, I use the closing monthly prices for the 5, 7, and 10-year G-bond. The data on the monthly Egyptian consumer price index and the monthly prices of Egyptian T-bills are collected using the database of the Egyptian Central Bank. Additionally, data on monthly prices of the Egyptian stock market indices and G-bond prices are collected from the Egyptian exchange database and the investing.com database. To calculate the nominal monthly return for the EGX indices, T-bills, and G-bonds, the study uses the following equation:

$$R_{i,t} = ln(P_{i,t}) - ln(P_{i,t-1} \qquad (1)$$

Where: $R_{i,t}$ is the monthly nominal return; and $P_{i,t}$ and $P_{i,t-1}$are the monthly closing prices of the stock indices, T-bills, and G-bonds for months t and t–1, respectively.

3.2 METHODOLOGY

To assess the dynamic relationships between the inflation rate and the returns of various Egyptian securities, the study will analyze the cointegration between the variables using linear and non-linear tests. This study uses the ARDL bound test that was introduced by Pesaran et al. (2001), and the NARDL bound test developed by Shin et al. (2014). The linear ARDL method checks whether the study variables are co-integrated or not using upper and lower bound values and assumes a symmetric response between variables. The NARDL test is an extension of the linear symmetric ARDL test and could investigate the non-linear and asymmetric effects between variables in the short- and long run. According to the ARDL or NARDL bound tests, all the study variables must be integrated into level I(0) or level I(1) (Pesaran et al., 2001 & Shin et al., 2014).

First, the relation between security returns and the inflation rate is evaluated through the following base long-run regression:

$$\mathrm{R_{i,t}} = \mathrm{B_0} + \mathrm{B_1}\ \mathrm{CPI_t} + \mathrm{e_t} \qquad (2)$$

Where $\mathrm{CPI_t}$ is the Egyptian inflation rate changes, $\mathrm{B_0}$ indicates the intercept and $\mathrm{e_t}$ is the error term. In addition, $\mathrm{B_1}$ represents the influence coefficient of the inflation rates on the securities return. To check whether there is cointegration between the inflation rate and securities returns and to obtain the short and long-run impacts of inflation rate on securities returns, the study uses the framework of linear symmetric ARDL model in error correction form as follows:

$$\Delta R_{i,t} = \delta_0 + \delta_1 R_{i,t-1} + \delta_2 CPI_{t-1} + \sum_{j=1}^{p} \chi_i \Delta R_{i,t-j} + \sum_{j=0}^{q} \gamma_i \Delta CPI_{t-j} + e_t \quad (3)$$

Where Δ is the first difference of the respective variable, p, and q represent restricted lags. The short-run effects between variables are determined by estimating first-order difference coefficients χ and γ for each variable, and the long-run effects are defined by δ_1 , δ_2 . The Bounds test, which involves F-statistics, is used to test the long-run co-integration relationship between variables. According to Pesaran et al. (2001), the null hypothesis is cited as $H_0: \delta_1 = \delta_2 = 0$ (variables are not cointegrated), and the alternative hypothesis is cited as $H_1: \delta_1 = \delta_2 \neq 0$ (variables are cointegrated). At a selected confidence level, if the value of the calculated F-statistic is greater than the upper bound, the null hypothesis is rejected, indicating that there is a long-run cointegration relationship between variables. If it is less than the lower bound, the null hypothesis is accepted, indicating that there is no long-run co-integration relationship between variables, but if it lies between the bounds, no specific results can be drawn conclusively (Pesaran et al., 2001). If the null hypothesis in equation (3) is rejected and there is a long-run co-integration relationship, the following unrestricted error correction model is estimated to describe the short-run dynamics relation between variables as follows:

$$\Delta R_{i,t} = \delta_0 + \sum_{j=1}^{p} \chi_i \Delta R_{i,t-j} + \sum_{j=0}^{q} \gamma_i \Delta CPI_{t-j} + \rho_1 ECT_{t-1} + e_t \quad (4)$$

Where ECT_{t-1} is the error correction term resulting from the long-run equilibrium relationship. The coefficient ρ_1 represents the speed of adjustment required to restore the long-run equilibrium after a short-run shock. The value of ρ_1 is expected to be negative and statistically significant to guarantee the convergence toward equilibrium.

Second, if the long-run co-integration relationship between variables exists, then the study proceeds to examine the asymmetric effects of positive and negative inflation shocks on security return, using the NARDL model. As suggested by Shin et al. (2014), the NARDL model is a decomposition of the ARDL model into a positive and negative partial sum of the explanatory variables. Okere et al.

(2021) pointed out that investors can react differently to positive and negative shocks leading to asymmetric reactions, so it is important to distinguish between positive and negative shocks in the explanatory variables. Thus, to investigate the asymmetric relationship between positive and negative inflation rate shocks and securities return, the following asymmetric long-run regression is explained as follows:

$$R_{i,t} = \beta_0 + \beta_1^{+} CPI_t^{+} + \beta_1^{-} CPI_t^{-} + e_t \quad (5)$$

Where CPI_t is decomposed as $CPI_t = CPI_0 + CPI_t^{+} + CPI_t^{-}$, where CPI_t^{+} and CPI_t^{-} are partial sum processes of positive and negative changes in CPI_t as follows:

$$CPI_t^{+} = \sum_{k=1}^{t} \Delta CPI_k^{+} = \sum_{k=1}^{t} Max(\Delta CPI_k^{+}, 0) \quad (6)$$

$$CPI_t^{-} = \sum_{k=1}^{t} \Delta CPI_k^{-} = \sum_{k=1}^{t} Min(\Delta CPI_k^{-}, 0) \quad (7)$$

To capture the short and long-run inflation rate asymmetries shocks on security return, the positive and negative partial sums decompositions are then added into the previous standard ADRL equation, where the NARDL model in error correction form is formulated as follows:

$$\Delta R_{i,t} = \delta_0 + \delta_1 R_{i,t-1} + \alpha_1^{+} CPI_{t-1}^{+} + \alpha_1^{-} CPI_{t-1}^{-} + \sum_{j=1}^{h} \omega_i \, \Delta R_{i,t-j} + \sum_{j=0}^{m} (\theta_i^{+} \Delta CPI_{t-j}^{+}) + \sum_{j=0}^{n} (\theta_i^{-} \Delta CPI_{t-j}^{-}) + e_t \quad (8)$$

The positive long-run coefficient β_1^{+} and the negative long-run coefficient β_1^{-} are the associated asymmetric long-run parameters, where $\beta_1^{+} = -\alpha_1^{+}/\delta_1$ and $\beta_1^{-} = -\alpha_1^{-}/\delta_1$. The study tests the long-run symmetric securities return reaction to the positive and negative shocks in the inflation rates using the null hypothesis that $\beta_1^{+} = \beta_1^{-}$ or that $-\alpha_1^{+}/\delta_1 = -\alpha_1^{-}/\delta_1$ (Shin et al., 2014). The short-run symmetry securities return reaction to the positive and negative shocks in the inflation rates is tested using the null hypothesis that $\sum_{j=0}^{m} \theta_i^{+} = \sum_{j=0}^{n} \theta_i^{-}$. The

Wald test is used to examine the short and long-run asymmetric reactions of security returns to the positive and negative inflation rate shocks. The Wald test follows an asymptotic χ^2 distribution (Shin et al., 2014).

4. RESULTS AND DISCUSSION

4.1 Descriptive statistics

Table 1 shows the descriptive statistics of the monthly changes in the Egyptian consumer price index CPI and monthly returns of each type of EGX indices, T-bills, and G-bonds.

Table 1: Descriptive statistics of study variables

Variables	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
CPI	0.97%	0.08	-0.02	1.24%	2.430	12.536	735.097***
EGX30	0.96%	0.31	-0.30	7.95%	0.057	5.139	29.444***
HFI	1.10%	0.31	-0.27	7.57%	-0.096	4.860	22.447***
EFGI	1.14%	0.29	-0.26	7.92%	-0.236	4.360	13.330***
T-bill-91	0.50%	0.19	-0.14	5.03%	0.574	5.270	41.503***
T-bill-182	0.56%	0.14	-0.16	4.45%	-0.246	6.003	54.417***
T-bill-364	0.38%	0.15	-0.20	4.63%	-0.600	6.947	93.623***
G-bond-5	0.51%	0.25	-0.20	4.85%	0.742	9.863	310.178***
G-bond-7	0.60%	0.27	-0.11	4.50%	1.800	11.466	539.550***
G-bond-10	0.43%	0.16	-0.10	3.89%	0.484	5.504	45.924***

Notes: The (***) denote significant at 1%, (**) significant at 5%, and (*) significant at 10% levels.

According to the results presented in Table 1, the mean returns of EFGI (1.14%) and HFI (1.10%) are higher than the mean returns of CPI (0.97%). However, the mean return of EGX30 (0.96%) is relatively lower than that of CPI. indicating that EFGI and HFI have a positive real rate of return. On the other hand, the CPI mean is relatively higher than the mean returns of all T-bills and G-bonds, indicating that T-bills and G-bonds have a negative real rate of return. The Maximum return of CPI is 0.08, and the Minimum return is -0.02. While the Maximum return of all EGX- stock indices is higher than that of T-bills and G-bonds, the Minimum return of all EGX- stock indices is lower than that of T-bills and G-bonds. The standard deviation of all EGX- stock indices is higher than that of T-bills and G-bonds indicating that EGX-indices returns are more volatile than that of T-bills and G-bonds. On the other hand, the standard deviation of the CPI is lower than all securities returns, which implies that the CPI is less volatile than all securities returns. The HFI, EFGI, T-bill-182, and T-bill-364 are negatively skewed, while the rest of the series are positively skewed. According to the skewness values, all the study variables exhibit kurtosis values over 3, indicating a departure from normal distribution. The results of the Jarque-Bera test confirm the rejection of the normal distribution hypothesis for all the study variables at a 1% significance level.

After conducting descriptive statistical tests, the study performed the Levene test to determine if there are significant differences between all the study securities returns variances. The result of the Levene test indicates that the Levene statistics value is 21.23, which is significant at the 1% confidence level. Consequently, the null hypothesis of equal securities return variances is rejected, and the alternative hypothesis is accepted, suggesting that there are significant differences between the all the study securities returns variances.

4.2 Unit root tests

Before conducting ARDL and NARDL tests, Pesaran et al. (2001) and Shen et al. (2014) emphasized that it is important to check for the presence of unit root in the study variables and ensure that their stationarity does not exceed the first order, I(1). The study employed augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) unit root tests to confirm that none of the study time series is stationary at the second order, I(2). The results of the ADF and PP unit root tests are presented in Table 2.

Table 2: Unit root tests

Variables	ADF	PP
CPI	-5.896***	-5.869***
EGX30	-12.047***	-12.058***
HFI	-11.925***	-11.974***
EFGI	-11.789***	-11.815***
T-bill-91	-6.595***	-12.538***
T-bill-182	-9.308***	-9.308***
T-bill-364	-5.896***	-9.356***
G-bond-5	-11.425***	-11.460***
G-bond-7	-12.141***	-12.218***
G-bond-10	-12.427***	-12.457***
Notes: The (***) denote significant at 1%, (**) significant at 5%, and (*) significant at 10% levels.		

Table 2 indicates that all series are stationary at level I(0) at a 1% significance level, according to ADF and PP unit root test results. Therefore, the study can proceed to estimate ARDL and NARDL models.

4.3 ARDL and NARDL models results

Table 3 presents the short and long-term results of the ARDL and NARDL models in three panels: (A) for EGX stock indices, (B) for T-bills, and (C) for G-bonds. The optimal lag for ARDL and NARDL models is the lag that achieves the criteria of no serial correlation or heteroskedasticity error problems. The lag of ARDL and NARDL models is selected based on Akaike Information Criteria with a maximum lag of four. The diagnostic statistics for each model indicate several tests, which are the F-bound and t-bound tests for a long-run cointegration relationship between variables, ECT(t-1) for the speed of adjustment, the adjusted R square, Jarque-Bera (JB) test for residuals normality, the LM test for residuals serial correlation, the ARCH test for residuals autoregressive conditional heteroskedasticity, and the Ramsey reset test to check the stability of the study models (models are correctly specified). The Wald tests are used to examine the short-run and long-run asymmetries. Furthermore, the study also conducts CUSUM and CUSUM square tests to provide more evidence for the stability of the NRDL models as shown in Figure 1 and 2.

Table 3: Linear and nonlinear ARDL models

Panel (A): EGX stock indices						
	EGX30		HFI		EFGI	
	ARDL	NARDL	ARDL	NARDL	ARDL	NARDL
Selected Model	(1,3)	(1, 2, 3)	(1,3)	(1, 4, 3)	(2,3)	(1, 2, 3)
Long-run coefficient						
CPI_t	2.255***		2.166***		2.199***	
	(0.000)		(0.000)		(0.000)	
CPI_t^+		2.044***		1.789**		2.135***
		(0.004)		(0.024)		(0.003)
CPI_t^-		2.027***		1.779**		2.126***
		(0.004)		(0.024)		(0.003)
Short-run coefficient						
constant	-0.014**	0.005	-0.012**	0.007	-0.012**	0.012
	(0.027)	(0.809)	(0.049)	(0.498)	(0.047)	(0.271)
$\Delta R_{i,t-1}$	N.A.	N.A.	N.A.	N.A.	0.107	N.A.
					(0.171)	
ΔCPI_t	-0.992*		-0.854		-0.797	
	(0.098)		(0.135)		(0.182)	
ΔCPI_{t-1}	-1.936***		-1.820***		-2.052***	
	(0.002)		(0.003)		(0.002)	
ΔCPI_{t-2}	-2.360***		-2.291***		-2.513***	
	(0.000)		(0.000)		(0.000)	
ΔCPI_t^+		0.009		0.007		-0.703
		(0.992)		(0.498)		(0.453)
ΔCPI_{t-1}^+		-2.578**		-2.270**		-2.847***
		(0.036)		(0.025)		(0.008)
ΔCPI_{t-2}^+		N.A.		-0.641		N.A.
				(0.541)		
ΔCPI_{t-3}^+		N.A.		1.867*		N.A.
				(0.059)		
ΔCPI_t^-		-1.007		-0.949		-0.731
		(0.450)		(0.410)		(0.523)
ΔCPI_{t-1}^-		-0.044		0.399		0.173
		(0.968)		(0.730)		(0.869)
CPI_{t-2}^-		-3.754***		-2.503**		-3.644***
		(0.000)		(0.021)		(0.000)
Diagnostic statistics						
F-Bounds Test	90.407***	59.597***	87.922***	54.899***	83.528***	57.958***
t-Bounds Test	-13.385***	13.292***	13.209***	12.925***	10.241***	13.077***
ECT_{t-1}	-1.064***	-1.051***	-1.047***	-1.040***	-1.148***	-1.027***
Adjusted R^2	0.567	0.562	0.563	0.594	0.559	0.569

Panel (A): EGX stock indices						
	EGX30		HFI		EFGI	
	ARDL	NARDL	ARDL	NARDL	ARDL	NARDL
JB (χ^2)	15.099***	21.117***	6.299**	11.884***	2.331	6.267**
LM (χ^2)	1.256	1.285	0.256	2.403	0.087	4.254
ARCH (χ^2)	1.332	1.346	2.180	4.209	3.400	9.009
Ramsey reset (F)	0.110	0.107	0.219	2.135	0.380	0.165
Asymmetries						
Wald -Long (χ^2)		0.422		0.198		0.154
Wald -Short (χ^2)		0.538		18.999***		0.305

Table 3: (Continued)

Panel (B): Treasury bills						
	T-bill-91		T-bill-182		T-bill-364	
	ARDL	NARDL	ARDL	NARDL	ARDL	NARDL
Selected Model	**(2,2)**	**(2,2,1)**	**(1,1)**	**(1,2,3)**	**(1,3)**	**(1,2,3)**
Long-run coefficient						
CPI_t	1.283***		1.472***		1.639***	
	(0.001)		(0.000)		(0.000)	
CPI_t^+		1.703***		2.319***		1.113***
		0.000		(0.000)		(0.000)
CPI_t^-		1.706***		2.316***		1.116***
		0.000		(0.000)		(0.000)
Short-run coefficient						
constant	-0.008	0.019***	-0.003**	0.022***	-0.010***	0.023***
	(0.048)	(0.002)	(0.013)	(0.000)	(0.005)	(0.000)
$\Delta R_{i,t-1}$	-0.181**	-0.177**	N.A.	N.A.	N.A.	N.A.
	(0.025)	(0.026)				
ΔCPI_t	0.242		0.297		-0.247	
	(0.509)		(0.537)		(0.469)	
ΔCPI_{t-1}	-0.904**		N.A.		-0.532	
	(0.014)				(0.142)	
ΔCPI_{t-2}	N.A.		N.A.		-0.697**	
					(0.043)	
ΔCPI_t^+		0.232		-0.105		-0.847
		(0.688)		(0.825)		(0.108)
ΔCPI_{t-1}^+		-2.347***		-2.294***		-1.762***
		(0.000)		(0.000)		(0.005)
ΔCPI_t^-		0.154		0.352		0.656
		(0.828)		(0.550)		(0.314)
ΔCPI_{t-1}^-		N.A.		1.225**		0.870

Panel (B): Treasury bills						
	T-bill-91		T-bill-182		T-bill-364	
	ARDL	NARDL	ARDL	NARDL	ARDL	NARDL
				(0.023)		(0.140)
ΔCPI^-_{t-2}		N.A.		N.A.		-1.281**
						(0.021)
Diagnostic statistics						
F-Bounds Test	29.545***	20.984***	63.675***	45.093***	62.775***	44.468***
t-Bounds Test	-7.663***	7.873***	11.200***	11.516***	11.199***	11.523***
ECT_{t-1}	-0.971***	-0.926***	-0.874***	-0.906***	-0.917***	-0.935***
Adjusted R^2	0.558	0.573	0.462	0.525	0.478	0.486
JB (χ^2)	14.316***	15.313***	101.739***	140.823***	182.653***	215.385***
LM (χ^2)	1.431	1.506	1.290	0.424	0.769	0.915
ARCH (χ^2)	0.661	0.333	0.016	0.091	0.019	0.029
Ramsey reset (F)	0.987	0.006	1.944	1.498	0.861	0.368
Asymmetries						
Wald -Long (χ^2)		0.036		0.020		0.060
Wald -Short (χ^2)		-		5.607**		0.037

Table 3: (Continued)

Panel (C): Government bonds						
	G-bond-5		G-bond-7		G-bond-10	
	ARDL	NARDL	ARDL	NARDL	ARDL	NARDL
Selected Model	**(1,0)**	**(1,0,0)**	**(1,0)**	**(1,0,0)**	**(1,1)**	**(2,0,0)**
Long-run coefficient						
CPI_t	0.657*		0.712***		0.791***	
	(0.042)		(0.009)		(0.001)	
CPI^+_t		0.622*		0.708**		0.625**
		(0.071)		(0.013)		(0.023)
CPI^-_t		0.613*		0.709**		0.636**
		(0.070)		(0.011)		(0.018)
Short-run coefficient						
constant	-0.001	0.000	0.002	0.006	-0.004	0.009***
	(0.735)	(0.918)	(0.485)	(0.482)	(0.139)	(0.007)
$\Delta R_{i,t-1}$	N.A.	N.A.	N.A.	N.A.	N.A.	0.129
						(0.120)
ΔCPI_t	N.A.		N.A.		0.366	
					(0.197)	
ΔCPI_{t-1}	N.A.		N.A.		N.A.	
ΔCPI^+_t		N.A.		N.A.		N.A.

Panel (C): Government bonds						
	G-bond-5		G-bond-7		G-bond-10	
	ARDL	NARDL	ARDL	NARDL	ARDL	NARDL
ΔCPI_{t-1}^{+}		N.A.		N.A.		N.A.
ΔCPI_{t}^{-}		N.A.		N.A.		N.A.
ΔCPI_{t-1}^{-}		N.A.		N.A.		N.A.
Diagnostic statistics						
F-Bounds Test	68.779***	44.185***	55.975***	55.600***	89.245***	21.212***
t-Bounds Test	11.725***	11.592***	-13.002***	-13.002***	13.347***	7.885***
ECT_{t-1}	-0.979***	-0.993***	-1.044***	-1.045***	-1.111***	-0.956***
Adjusted R^2	0.486	0.499	0.532	0.532	0.551	0.551
JB (χ^2)	323.588***	265.658***	776.525***	784.706***	47.253***	49.898***
LM (χ^2)	0.632	0.894	0.6224	0.625	0.376	0.996
ARCH (χ^2)	0.613	0.674	0.043	0.043	0.022	0.059
Ramsey reset (F)	0.303	0.092	0.488	0.445	1.826	0.217
Asymmetries						
Wald -Long (χ^2)		0.203		0.054		0.277
Wald -Short (χ^2)		-		-		-

Note: The table shows the estimated long and short-run coefficients for the linear ARDL and the nonlinear ARDL models described in Eq. (2), (3), (5), and (8), where the dependent variable is (Ri) and the independent variable (CPI). The (***) denote significant at 1%, (**) significant at 5%, and (*) significant at 10% levels. N.A., denotes no lag available at the respective order.

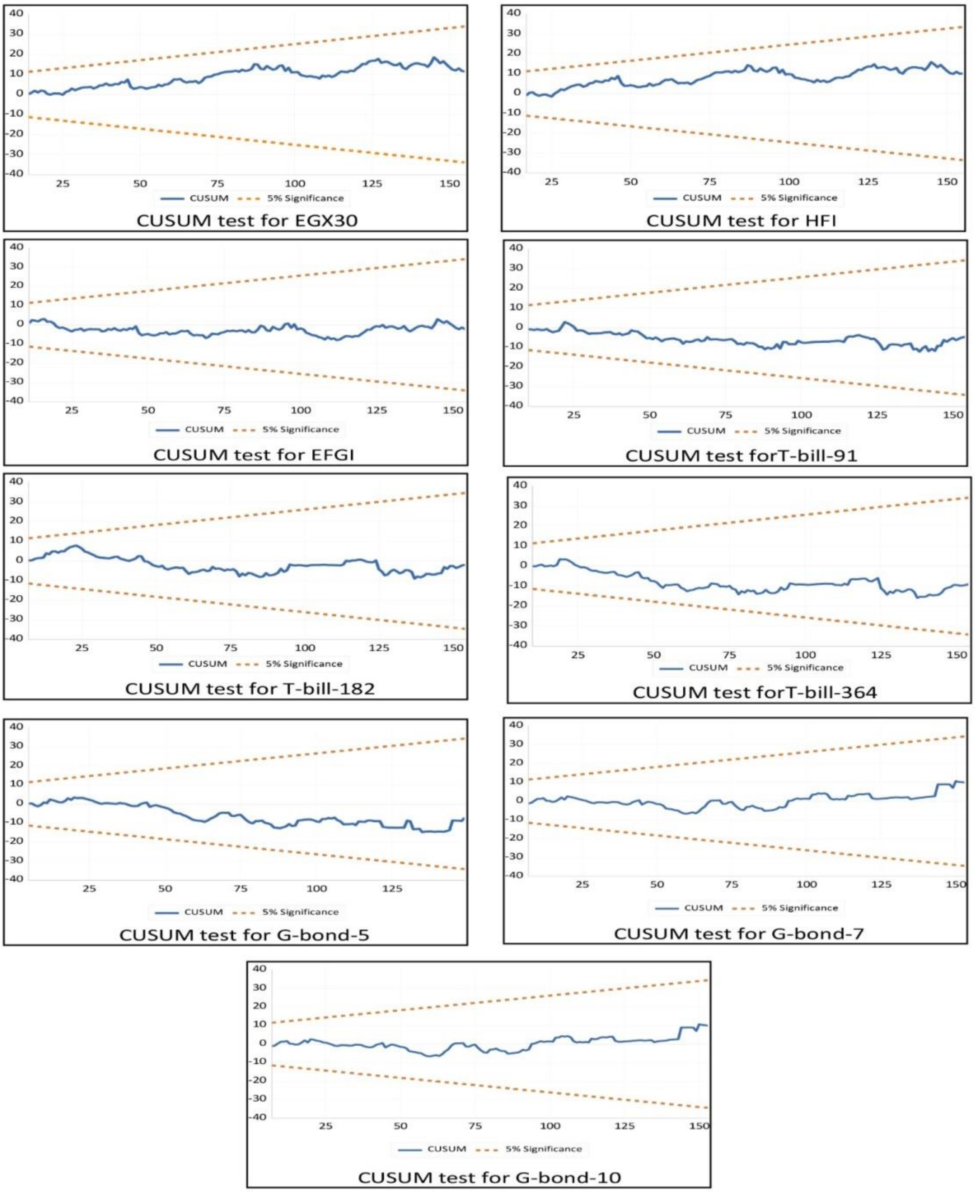

Figure 1: CUSUM test

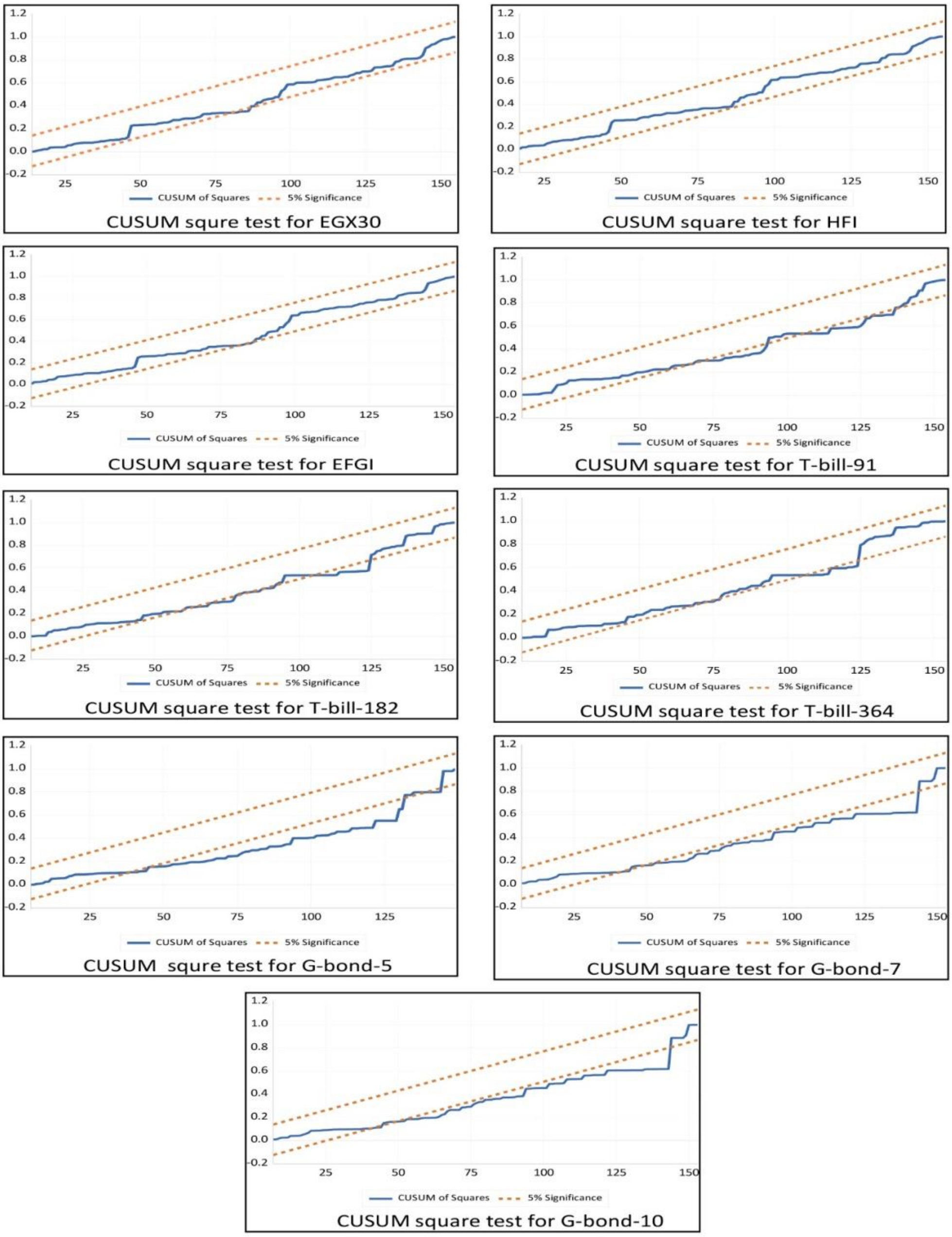

Figure 2: CUSUM square test

As presented in Table 3, the results of the diagnostic tests for all ARDL and NADL models are satisfactory. The estimated F-statistics and t-statistics for all ARDL and NARDL models are higher than the upper bound, which indicates the rejection of the null hypothesis of no cointegration relationship, proving the presence of long-run cointegration relation between CPI and stock indices, T-bills, and G-bonds. The coefficient of error correction term ECT(t−1) is negative and statistically significant at a 1% level for all the study models, which means that after a short-run shock, the long-run equilibrium will be restored. The adjusted R square in all study models ranges from 46% to 59%. Although normality is rejected for most of the study models, no autocorrelation or heteroscedasticity is present for all models. Finally, the Ramsey reset test results show no misspecification and stability for all ARDL and NARDL study models. Finally, CUSUM and CUSUM squares tests are considered stable at a 5% significance for all securities models, as shown in Figures 1 and 2.

4.3.1 The relationship between the stock market real returns and inflation rate

Table 3, in panel (A), indicates that both the ARDL and NARDL models provide strong evidence of a connection between the EGX stock indices (EGX30, HFI, and EFGI) and the inflation rate. In terms of the long-term relationship, the linear ARDL models indicate a positive relationship between all EGX index returns and the inflation rate. The long-run coefficients of the inflation rate (CPI) are positive and statistically significant at a 1% level with all EGX indices. A one percent increase or decrease in the inflation rate is associated with a 2.16 to 2.25 percent increase or decrease in the EGX indices' return in the long run. The NARDL analysis reveals that positive and negative inflation rate shocks have a symmetric positive effect on the EGX indices' return in the long run. The long-run coefficients of positive and negative CPI are also positive and statistically significant with all EGX returns. A one percent increase or decrease in the positive or negative inflation rate is associated with an approximated 1.78% to 2.13% percent increase or decrease in the EGX returns with a 99% confidence for EGX30 and EFGI and 95% confidence for HFI. The Wald statistics for the long-run coefficients are insignificant for all EGX stock indices, which suggests the symmetric effects of positive and negative inflation shocks on all stock price indices in the long run. Based on these results, the significant positive symmetric relationship of EGX30, HFI, and EFGI indices return with positive and negative CPI implies that Egyptian stock market returns are an effective hedge against the inflation rate in the long run.

Concerning the short-run relationship between stock EGX indices and inflation rates, the linear ARDL models indicate a negative relationship between all EGX indices and the inflation rate variable (CPI). The short-run coefficient of ΔCIP is negative and significant at a 1% level for all EGX returns at lag (t-1) and lag (t-2). ΔCIP is also negative and significant at a 10% level for EGX30 returns at lag (t). The NARDL analysis reveals a significant negative relationship between EGX indices and the positive and negative inflation shocks in the short run. The coefficient of ΔCIP-positive is negative and significant with all EGX indices return at lag (t-1), with a 99% confidence for EFGI and 95% confidence for EGX30 and HFI. The coefficient of ΔCIP-positive is positive and significant at a 10% level with HFI at lag (t-3). The coefficient of ΔCIP-negative is negative and significant with all EGX indices return at lag (t-2), with a 99% confidence for EGX30 and EFGI and 95% confidence for HFI. The Wald test statistics for the short-run coefficients are insignificant for EGX30 and EFGI indices, which suggests the symmetric negative effects of positive and negative inflation shocks on these indices' return in the short run. As for the HFI index, the Wald test statistic is significant in the short run, indicating asymmetric negative effects of positive and negative inflation shocks on this index return in the short run. These results about the significant negative effects of positive and negative inflation shocks on EGX30, HFI, and EFGI indices, imply that stock market returns are not an effective hedge against the inflation rate in Egypt in the short run.

These findings about Egyptian stock market returns make it clear that there is only partial confirmation of the study hypothesis H1. The significant positive symmetric relationship between the positive and negative inflation rate shocks and the Egyptian stock returns is observed only in the long run not in the short run. Therefore, these results demonstrate that the Egyptian stock market returns possess symmetric inflation hedging capabilities in the long run. These findings are consistent with Fisher's hypothesis and support the studies that found stock returns constitute hedges against inflation in the long term but not in the short term (see, for example, Akmal, 2007; Rushdi et al., 2012 & Ibrahim and Agbaje, 2013). However, these results are not consistent with the studies that found that the effects of inflation shocks on stock returns were generally negative and asymmetric in the short and long run (see, for example, Alqaralleh, 2020 & Sia et al., 2023).

4.3.2 The relationship between the T-bill real returns and inflation rate

Table 3, in panel (B), shows that the ARDL and NARDL models provide clear evidence of a link between the Egyptian T-bill-91, 182, and 264-day and the inflation rate. In terms of the long-run relationship, the linear ARDL models indicate a positive relationship between the T-bills returns and the inflation rate. The long-run coefficients of CPI are positive and statistically significant at a 1% level. A one percent increase or decrease in the inflation rate is associated with a 1.28 to 1.63 percent increase or decrease in the T-bills returns in the long run. These values of the CPI coefficient with T-bills indicate that the sensitivity of T-bills returns to changes in the inflation rate is lower than that of the stock indices in the long run. The NARDL analysis reveals symmetric positive effects of positive and negative inflation rate shocks on the returns of all T-bills. The long-run coefficients of positive and negative CPI are positive and statistically significant at a 1% level. A one percent increase or decrease in the positive or negative inflation rates is associated with a 1.11 to 2.31 percent increase or decrease in all T-bills returns. The Wald test statistics for the long-run coefficients are insignificant for all T-bill models, which suggests non-rejection of the symmetric effects of positive and negative inflation shocks on the T-bill returns. These results about the significant symmetric positive relationship between all T-bill returns and CPI, regardless of the T-bill maturity date, imply that T-bill returns are an effective hedge against inflation shocks in the long run.

In the short run, the linear ARDL models indicate a negative relationship between the inflation rate (CPI) and some T-bills. The short-run coefficient of

ΔCIP is negative and significant at a 5% level for the T-bill-91 at lag (t-1) and the T-bill-364 at lag (t-2). However, the NARDL analysis yields mixed results regarding the effects of positive and negative inflation shocks on T-bills in the short run. The coefficient of ΔCIP-positive is negative and significant at a 1% level with all T-bills return at lag (t-1). On the other hand, for ΔCIP-negative, the T-bill-91 return is not significantly affected by ΔCIP-negative, the T-bill-182 return is positively affected by ΔCIP-negative significantly at lag (t-1) with 95% confidence, and the T-bill-364 return is negatively affected by ΔCIP-negative significantly at lag (t-2) with 95% confidence. The Wald test statistics for the short-run coefficients are insignificant for T-bill-364 and significant for T-bill-182, suggesting symmetric effects of positive and negative inflation shocks on T-bill-364 and asymmetric effects on T-bill-182. The Wald test is not performed for the T-bill-91 returns because it is only significantly affected by ΔCIP-positive shocks, not by ΔCIP-negative shocks. These results about the significant negative effects of positive inflation shocks on all T-bills indicate that T-bill returns are not an effective hedge against the inflation rise shocks in Egypt in the short run.

The findings regarding the Egyptian T-bills indicate that the study hypothesis H2 is only partially accepted. The significant positive symmetric relationship between the positive and negative inflation shocks and the Egyptian T-bills return only exists in the long run and not in the short run. These results support the symmetric inflation hedging capabilities for the Egyptian T-bills return in the long run. These findings comply with Spierdijk and Umar's study (2015) that found T-bills return as a good long-term hedge against inflation. However, these results contradict Lee and Isa's study (2019), which found that the government treasury bills did not cointegrate with inflation.

4.3.3 The relationship between the G-bond real returns and inflation rate

Table 3, in panel (C), presents the results of ARDL and NARDL analyses, which indicate evidence of a relationship between the Egyptian G-bond-5, 7, and 10-year horizons and the inflation rate. In the long run, the linear ARDL models indicate a positive relationship between the G-bonds returns and the inflation rate. The long-run coefficients of the inflation rate (CPI) are positive and statistically significant at a 10% level for G-bond-5-year and a 1% level for G-bond-7 and 10-year. A one percent increase or decrease in the inflation rate is associated with a 0.65 to 0.79 percent increase or decrease in the G-bond returns in the long run. The NARDL analysis shows that the returns of all G-bonds are positively sensitive to the positive and negative inflation rate shocks. The long-run coefficients of positive and negative CPI are positive and statistically significant at a 10% level for G-bond-5 year and a 5% level for G-bond-7 and 10-year. A one percent increase or decrease in the positive or negative inflation rates is associated with a 0.61 to 0.70 percent increase or decrease in G-bonds returns. The long-run coefficient values of CPI and CIP-positive or CPI-negative with all G-bonds reveal that the sensitivity of the G-bond returns to the inflation rate changes is lower than that of stock indices and T-bills in the long run. The Wald test statistics for the long-run coefficients of positive and negative CPI are insignificant for all G-bond models, indicating the symmetric effects of positive and negative inflation shocks on all G-bonds returns. The significant symmetric positive relationship between the G-bond returns and CPI, regardless of the maturity date, implies that the G-bond returns are an effective hedge against the inflation rate in the long run.

In the short run, the linear ARDL models indicate that changes in ΔCIP do not affect the returns of all G-bonds at any lag. Although the coefficient of ΔCPI is positive with G-bond-10 at lag (t), this value is statistically insignificant. The NARDL analysis also shows that there are no relations between all G-bond returns and ΔCIP-positive or negative at any lag in the short run. The Wald test is not performed for all G-bonds because they are not affected by positive or negative ΔCIP at any lag in the short run. These results about insignificant effects of inflation shocks on G-bonds indicate that the G-bonds returns are not an effective hedge against the inflation shocks in Egypt in the short run.

These results about the Egyptian G-bonds indicate partial proof of the study hypothesis H3. The significant positive symmetric relationship between the positive and negative inflation shocks and the G-bond returns exists only in the long run but not in the short run. These results support the symmetric inflation hedging capabilities for the Egyptian G-bonds return in the long run. These findings are consistent with Lee and Isa's study (2019), which found that the G-bond returns as a good long-term hedge against inflation. However, these results do not support Spierdijk and Umar's study (2015) that found US bonds were ineffective in inflation hedging.

5. CONCLUSION AND IMPLICATIONS

This study investigates the inflation hedge abilities of Egyptian stock market returns compared to the returns of T-bills and G-bonds, covering the data period from January 2011 to December 2023. Using the linear ARDL framework, the study estimates the cointegration and the long and short-run inflation shocks on Egyptian securities. Additionally, applying the NARDL framework, the inflation rate is decomposed into positive and negative partial sum to explore the symmetric or asymmetric relationship between securities return and positive and negative inflation shocks.

The application of the ARDL and NARDL models confirms the presence of long run cointegration relations between the inflation rate and the returns of stock market indices, treasury bills, and government bonds in Egypt. Among securities, stocks are the most sensitive to changes in the inflation rate, while G-bonds are the least. In the long run, the results estimated from the linear ARDL indicate a positive relationship between inflation rates and the returns of stock indices, T-bills, and G-bonds. The NARDL analysis and Wald test provide evidence of a positive symmetric relationship between positive and negative changes in the inflation rate and the returns of stock indices, T-bills, and G-bonds. The results suggest that there is no significant difference in the impact between positive inflation shocks (increases in the inflation rate) and negative inflation shocks (decreases in the inflation rate) on equity and debt government securities. According to these findings, the returns of Egyptian stock indices have a high ability to hedge against inflation shocks, as well as the returns of Egyptian Treasury bills and government bonds in the long run.

In the short run, the results of the ARDL model indicate a negative relationship between the inflation rate and the returns of stock indices and T-bills. However, no significant relationship has been detected between the inflation rate and G-bond returns at any lag. The NARDL results reveal the negative effects of positive and negative inflation rate shocks on the returns of stock indices. These negative effects of positive and negative inflation shocks are symmetric on the EGX30 and EFGI indices and asymmetric on the HFI index. As for T-bills, all T-bill returns are affected negatively by positive inflation shocks, but the effects of negative inflation shocks vary across T-bill kinds. The negative inflation shocks have no effects on T-bill-90, positive effects on T-bill-182, and negative effects on T-bill-364. The effects of the positive and negative inflation shocks are asymmetric on T-bill-182 and symmetric on T-bill-364. The G-bond returns are not affected by any of the positive or negative inflation shocks at any lag in the short run. Accordingly, these findings about the significant negative effects of positive inflation shocks on stocks and T-bills, and no effects on G-bonds, indicate that the returns of these securities are unable to hedge against inflation rises in the short run.

The previous results of the ARDL model are consistent with the studies conducted by Akmal (2007), Rushdi et al. (2012), Ibrahim and Agbaje (2013), and Al-Nassar and Bhatti (2019), which used the ARDL model and provided evidence that stock returns are a good hedge against inflation in the long term but not in the short term. However, the previous results of the NARDL model are not consistent with the studies conducted by Alqaralleh (2020) and Sia et al. (2023), which used the NARDL model and provided evidence that the effects of inflation shocks on stock returns were negative and asymmetric in the long run. The study attributes these differences to the fact that these previous studies, unlike this study, were conducted during times that did not witness any fundamental changes in inflation rates.

This study has found evidence in Egypt, suggesting that during periods of significant shifts in inflation rates, the Egyptian stock market can be considered a safe haven in the long run. The stock returns can provide good hedging against inflation risks as various Egyptian government debt securities in the long run. However, in the short term, all Egyptian securities, including stocks and government debt securities, cannot hedge inflation rise shocks during periods that experience significant changes in inflation rates. These results have significant implications for investors and policymakers.

These study findings provide useful insights to investors and portfolio managers about investing in the Egyptian stock market and how it can offer inflation hedging in the long run, same as the T-bill and G-bond securities. Therefore, investors could consider Egyptian stock investment in their investment portfolio to effectively hedge against inflation on the long-term horizon, even during periods of sharp fluctuations in inflation rates.

Furthermore, these study results provide valuable information to Policymakers and regulators about the inability of securities returns to hedge against inflation shocks in the short run. These findings highlight the need to develop financial and monetary policies that could protect securities returns from the effect of inflation risk, particularly stocks that are not linked directly to interest rate policies.

Finally, future research could expand the framework of studying the mutual relationship between inflation and securities to include different factors, countries, and times. For example, researchers could expand this investigation to include other economic factors affecting securities returns and the inflation rate. Furthermore, they can also compare the impact of positive and negative inflation shocks on the Egyptian securities market with some emerging and developed markets.

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القدرة التحوطية من التضخم لعوائد الأسهم مقارنة بأوراق الدين الحكومية في مصر باستخدام إطاري NARDL, ARDL

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ملخص البحث باللغة العربية

تهدف هذه الدراسة إلى التحقق من مدى قدرة عوائد سوق الأسهم المصرية على التحوط من التضخم مقارنة بعوائد أذون الخزانة والسندات الحكومية في مصر. واعتمدت الدراسة في ذلك على البيانات الشهرية من مارس 2011 إلى ديسمبر 2023، وباستخدام إطاري الانحدار الذاتي للفجوات الزمنية الموزعة الخطي وغير الخطي (ARDL & NARDL). فعلى المدى الطويل، تظهر نتائج الدراسة علاقة إيجابية متناظرة بين الصدمات الإيجابية والسلبية لمعدلات التضخم وعوائد مؤشرات سوق الأسهم وأذون الخزانة والسندات الحكومية. أما على المدى القصير، فتشير النتائج إلى وجود تأثير سلبي لصدمات ارتفاع التضخم على عوائد الأسهم وأذون الخزانة، بينما لم تتأثر عوائد السندات الحكومية بصدمات ارتفاع التضخم بشكل ملحوظ.

وتشير هذه النتائج إلى أنه على المدى الطويل، يمكن اعتبار عوائد سوق الأسهم المصرية ملاذاً آمناً ويمكن أن توفر تحوطاً جيداً ضد مخاطر التضخم مثلها في ذلك مثل أوراق الدين الحكومية المصرية المختلفة ذات الدخل الثابت. نتائج هذه الدراسة لها آثار هامة بالنسبة للمستثمرين، حيث يمكن للمستثمرين اعتبار الأسهم المصرية كأصول تحوطية فعالة في محافظهم ضد التضخم على المدى الطويل، حتى خلال فترات التقلبات الحادة في معدلات التضخم. بالإضافة إلى ذلك، تم استنتاج بعض الآثار الهامة لصانعي السياسات، وذلك من خلال النتائج الخاصة بالقدرة على تحوط الأوراق المالية من التضخم على المدى القصير.

الكلمات الدالة: الأسهم، أذون الخزانة، السندات الحكومية، التضخم، التحوط، مصر، الأسواق الناشئة، ARDL، NARDL.

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