Could stocks hedge against inflation in the MENA region?

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School of Business

Could Stocks Hedge against Inflation in the MENA Region?

A Thesis Submitted to the Department of Management

In partial fulfillment of the requirements for the degree of Masters of Science in Finance

By Laila El Adly

Under the Supervision of Dr. Neveen Ahmed

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List of Abbreviations

ADF  Augmented Dickey Fuller
AIC  Akaike information criterion
ARMA Autoregressive Moving Average
ARIMA Autoregressive Integrated Moving Average
ASE  Amman Stock Exchange
BKAM Bank Al-Maghrib
CAPMAS Central Agency for Public Mobilization and Statistics
CBE  Central Bank of Egypt
CBJ  Central Bank of Jordan
CPI  Consumer Price Index
DFMGI Dubai Financial Market General Index
DJGI Dow Jones Global Index
ECM Error Correction Model
EEDC Egypt Economic Development Conference
EGX Egypt Stock Exchange
FY  Fiscal Year
GCC Gulf Countries Council
GNP Gross National Product
GoE Government of Egypt
IMF International Monetary Fund
KSX Kuwait Stock Exchange
MENA Middle East and North Africa
OLS Ordinary Least Squares
OPEC Organization of the Petroleum Exporting Countries
QSE Qatar Stock Exchange
T-BILL Treasury Bill
UAE United Arab Emirates
USD United States Dollar
VECM Vector Error Correction Model
Y-O-Y Year on Year
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Cairo, May 2017.
Abstract

The dissertation examines the effect of unexpected inflation on stock returns in the MENA region (Egypt, Jordan, Kuwait, Morocco, Qatar, United Arab Emirates (UAE), Tunisia, and Saudi Arabia). Our sample covers the MENA region over the period 2005 – 2016. We examine the long run relation between unexpected inflation and stock returns using the Vector Error Correction Model (VECM) and we model for the unexpected inflation using Autoregressive Moving Average (ARMA). Also, we capture the joint volatility dynamics between unexpected inflation and stock returns using the multivariate VECH-GARCH. The results reveal that there are variations depending on the country examined. Using Johansen (1995) trace test for co-integration, our results affirm the existence of long run relation between stock returns and unexpected inflation in Egypt and Jordan. As for the other countries, there are short-term dynamic linkages between the two variables in Kuwait, Morocco, Qatar, UAE, and Saudi Arabia. For modelling the volatility of unexpected inflation and stock returns, we use the VECH-GARCH. The volatility results suggest that the news effect has a significant and positive impact on stock returns in Jordan, Kuwait, Qatar, Dubai, and Saudi Arabia. On the other hand, the memory effect of the volatility in stock returns is significant for all countries except Tunisia and Egypt.

JEL Classification: C32 E31 G15

Key words: Unexpected inflation, VECM, ARMA, VECH-GARCH, Co-integration, MENA Region, Long Memory.
1. Introduction

Huge movements in stock prices could lead to sudden increases or decreases in investor wealth. According to the traditional financial theory, the reasons for such movements in stock prices are attributed to macroeconomic fundamentals. However, empirical studies have shown that linking large movements in stock prices to macroeconomic fundamentals has been marginally successful (McQueen and Adams and Wood, 2014). In a study conducted by Fair (2000), it was concluded after examining intraday returns that many large price changes “are not due to identifiable events”. Although, the empirical link between news and stock prices has been challenged, the literature offers many studies, which have various explanations behind the changes in stock prices. Among the main reasons behind major changes in stock prices are surprise announcements in inflation, or unexpected inflation. In this study, we align inflation announcement surprises (unexpected changes in price indices) with monthly stock returns to gain insights into the following research questions: How does unexpected inflation affect stock returns in MENA on both the short-run and the long run? Could stocks be used as a hedge against inflation? Is there a news effect impact and long run memory in unexpected inflation and stock returns?

Our choice of unexpected inflation as a variable stems from the fact that it could cause high volatility and macroeconomic instability. Therefore, when there is a high volatility in the economy, it is expected that investors will be less incentivized to invest in the stock market (Naceuret. Al., 2007). Therefore, unexpected inflation could affect the stock market negatively. Furthermore, evidence has shown that inflation is detrimental to economic growth. Specifically, in the MENA region, inflation influences economic growth negatively and significantly (Naceur et Al., 2007). Due to inflation’s negative effect on the economy, it is important for investors to know how the stock market responds to unexpected inflation.

Empirical literature which studies the movement of financial asset prices in response to inflation have revealed controversial conclusions (Diaz and Jareno, 2012). Some of the studies previously conducted show that the relationship between unexpected inflation and stock returns is significant and negative (Bodie, 1976; Jaffe and Mandelker, 1976; Nelson, 1976; Fama and Schwert, 1977; Schwert, 1981; Fama, 1981; Chatrath et Al., 1997). Another study by Jain (1988) finds that the effect of unexpected inflation on stock returns is significant. Jain’s study reveals that the stock response is efficient, “showing up in the first hour but not subsequent hours” (Fair,
A study by Amihud (1996) reveals that daily stock returns are significantly linked to the Consumer Price Index (CPI) inflation news in Israel. Other studies show that the relationship is insignificant (Pearce and Roley, 1983; Hardouvelis, 1987; McQueen and Roley, 1993; Caporale and Jung, 1997). McQueen and Roley (1993) find that the relationship between unexpected inflation and stock returns is “sometimes significant after controlling for different stages of the business cycle” (Fair, 2000).

For the question of whether stock returns could act as a hedge against inflation, it is also debatable according to previous research. In order for stocks to act as a hedge against inflation, the effects of expected inflation should be compensated in nominal stock returns (Shah, Nasr and Naeem, 2012). As Fisher (1930) hypothesized, expected return of a security is a function of expected inflation rate and expected real interest rate. Furthermore, Bodie (1976) built upon Fisher’s work and hypothesized that the actual return of a security depends on the expected and unexpected inflation, as well as expected and unexpected nominal returns. Another theory by Geske and Roll (1983), states that since stocks represent claims on real assets, inflation would cause the prices of securities to increase and thus their value would be elevated. Hence, Geske and Roll’s (1983) theory is supportive to the positive relationship between inflation and security prices.

As aforementioned, many studies have revealed results, which go against those theories by providing a negative relationship between stock returns and inflation. The negative results shown in those studies have led to the formation of other hypotheses, such as the tax-augmented hypothesis, to explain the contradiction (Shah, Nasr and Naeem, 2012). The tax-augmented hypothesis states that there is a negative relationship between inflation and stock returns when taxes are taken into account. The theory relies on how inflation causes higher taxes and therefore affects returns negatively. This implies that other theories did not empirically take taxes into account.

Prior research also shows that the stock response to any news in general may vary according to other factors as well. The response may differ due to the state of the economy (McQueen and Roley, 1993), and the type of news (whether it is good or bad news) (Bae and Karolyi, 1994). Moreover, numerous recent papers suggest that the results of some early studies are contradictory due to the biasedness created when market scenarios counteract each other. Those papers base their suggestions on Veronesi’s (1999) theoretical model, which states that the
investor reaction to inflation varies depending on the market condition. Therefore, the conclusions of previous studies could differ as a result of the various factors which affect investor response including the economic conditions and the state of the business state cycle (Diaz and Jareno, 2012), and the direction of the news (McQueen and Adams and Wood, 2014). With regards to the speed of the stocks’ response, studies have shown that the response has increased with the development of technology (Fargher and Weigand, 1998). After examining the effect of unexpected inflation on monthly stock returns of 8 countries in the MENA region, we find that our results are consistent with Veronesi’s (1999) theory and that the response of stock returns to unexpected inflation depends on several factors including the country evaluated and its economic conditions.

The thesis is organized as follows: section 2 explains the literature review, section 3 describes the data, section 4 explains the model and methodology, and section 5 shows the results. Finally, the last section includes a summary of the main results and conclusions.

2. Literature Review

2.1 Relationship between expected inflation on stock returns

The relationship between stock market returns and inflation has been widely studied, resulting in various literature on the link between these two variables. Historical research suggests that there is a relationship between stock market returns and expected inflation. Despite the fact that there are many studies on the link between these variables, there is no consensus on the direction of the relationship.

The literature discussing inflation and stock returns began during the early twentieth Century (Bai, 2014) and have produced some valuable viewpoints and conclusions. Theories such as the Fisher Hypothesis and the Proxy Hypothesis provide explanations to the relationship.

2.1.1 The Fisher Hypothesis

The Fisher Hypothesis is considered one of the core inflation hedging research and it has been applied to previous studies. The theory’s main idea is that since stocks represents claims to real assets, their real rate of return should be uncorrelated to the underlying inflation rate. In other words, since common stocks could be considered capital goods, it could be assumed that the increase in the general prices of commodities in the economy would also increase the price of
stocks. Thus, when there is inflation, stock prices should compensate investors for the inflation. This is a prediction that is consistent with the classical view of mutually independent nominal and real sectors (Fisher, 1930).

As aforementioned, the Fisher’s hypothesis relies on money neutrality and the separation between monetary and real terms. The hypothesis suggests that the expected nominal interest rate in fixed income equals the expected inflation and a constant real rate. Thus, according to this theory, the nominal interest rate is expected to move one for one with expected inflation. Since the theory has many implications on inflation hedging, various empirical studies have taken the Fisher Hypothesis and modified it to reach conclusions beyond fixed income.

2.1.2 The Original Fisher Hypothesis

Fisher’s original hypothesis (1930) predicts a one for one ex ante relation between returns and inflation.

\[ E(r_n) = \alpha + \beta E(\pi) + \varepsilon \]  

(1)

In equation (1), \( r_n \) represents the nominal return of an asset, \( \alpha \) a constant real return, and \( \beta \) is the asset’s correlation coefficient with expected inflation \( E(\pi) \), which is expected to be equal to one. It should be pointed out that this framework might be less suitable for long term analysis because in some cases it is difficult to anticipate expected inflation on a long horizon. Also, the framework could be less suitable for commodities or equities which have ambiguous observable expected returns (Rodel, 2012). In order to solve for this problem, an ex-post version for the Fisher equation has been created in various empirical studies.

2.1.3 The Ex-post Version of Fisher Hypothesis

As a result of the unsystematic forecasting errors between expected and realized inflation and unbiased return expectations, the following ex-post version of Fisher Hypothesis was created.

\[ r_n = \alpha + \beta \pi + \varepsilon \]  

(2)
Equation (2) suggests a one to one relation between realized nominal returns $r_n$ and realized inflation ($\pi$). This framework has been used in multiple studies for long-run cross-country equity analysis such as Cagan’s study (1974). Other studies also used this framework to analyze several assets in different countries over different investment horizons such as Bekaert and Wang’s study (2010). Furthermore, a study by Alagidede (2009) which analyzed the effect of inflation on stock returns, provided results that were consistent with the Fisher Hypothesis. The study focused on African countries and revealed that on the long run, common stocks in Kenya, Nigeria, and Tunisia, provide a hedge against inflation.

### 2.1.4 Expected Inflation Proxies

In previous literature, authors have used different proxies for expected inflation such as survey data (Hasbrouk, 1984), comparisons between nominal and inflation indexed yields at the same maturity (Macchiarelli, 2014), Central Bank forecasts or forecasts conducted by professionals (Melnick, 2016), price reaction of the CPI-linked bonds after the announcement of the official CPI (Amihud, 1996), and Treasury-bill yields. The assumption made for using T-bill yields is that changes in yields were mainly caused by changes in expected inflation (Palkar and Wilcox, 2009). Also, many other authors have used alternative time series models to provide estimates of expected inflation (Gultekin, 1983). For example Pearce and Roley (1988), Schwert (1981), Fraser et al. (2002), Mestel and Gurgul (2003), and Jareño (2008), used simple time series Auto Regressive Integrated Moving Average (ARIMA) models to estimate the expected inflation component. Those studies assume that the current total inflation rate is composed of expected and unexpected inflation components. In order to estimate the expected component, those studies use ARIMA models. After that, the forecast errors of the ARIMA models are used to estimate the unexpected inflation.

### 2.1.5 Research Results on Expected Inflation

Although the Fisher hypothesis is considered one of the main elements in inflation hedging research, there are a few models such as the “Fed Model” which have diverted from the Fisher framework. The Fed Model is an empirically inspired model by Yardeni (1999) which relies on a simplified Gordon Growth Model (1959). In the simplified Gordon Growth Model, equity
premium and growth offset each other. The idea is based on the competition of asset classes for portfolio share. Therefore, according to this theory, the dividends of stocks should move along with nominal Treasury bonds; there should be at least a high correlation between them. This theory was tested on US data and several researchers have found that there is a correlation between dividends of stocks and nominal Treasury bonds (Asness, 2003). The results of those studies revealed contradictory results to the predictions of Fisher. It was implied from the results that since dividends are rather slow moving, equity prices decrease when there is a high inflation level.

The view that stocks could be used as inflation-hedging investments was also challenged through a number of empirical studies which showed persuasive evidence supporting inflation’s negative effect on the short run stock returns (one year or less). Moreover, according to Alagidedea and Panagiotidisb’s 2010 study about whether common stocks could provide a hedge against inflation, the response of stock prices to a shock in consumer prices is initially negative in short-run. However, the response turns positive over the long-run. Boudoukh and Richardson (1993) also state the same conclusion through their study which showed that stocks provide better inflation hedges over five-year periods than over one-year periods (Campbell and Vuolteenaho, 2004). The theory of stock returns as hedge for inflation on the long-run was also supported by Ely and Robinson (1997), who used a vector error correction model applied to 17 countries individually. Their results show that the source of inflation, whether it’s real or monetary, does not affect the final outcome. However, Hess and Lee (1999) argue that the source of inflation affects the results especially in the US, UK, Germany, and Japan. According to Hess and Lee (1999), those countries have negative (positive) correlation for real output (monetary) shocks. In Lothian and McCarthy’s study (2001), a positive relationship between inflation and stock returns is found in 14 developed countries.

On the other hand, there are many previous studies conducted which reveal a negative relationship between inflation and stock returns (Boudloukh and Richardson, 1993). In many of those studies, the results show that, typically, the coefficient of the inflation term in a stock return equation is negative and statistically different from one (e.g., Lintner, 1975; Bodie, 1976; Jaffe and Mandelker, 1976; Nelson, 1976; Fama and Schwert, 1977; Geske and Roll, 1983; Pearce and Roley, 1983; Pearce, 1985). Many researchers attempted to explain why this is the
case (e.g., Modigliani and Cohn, 1979; Feldstein, 1980; Fama, 1981; Geske and Roll, 1983; Titman and Warga, 1989).

Fama (1981) used the ‘money demand proxy hypothesis’ to explain the relationship, while Modigliani and Cohn (1979) proposed the collective money illusion, and Feldstein (1980) non-neutralities in the tax treatment of the inventory and depreciation. The proxy hypothesis proposed by Fama (1981), argues that because stock returns are positively related to future real economic growth, as inflation increases, real economic growth declines and become more volatile which pushes investors to require higher risk premiums to cover the additional risk. Therefore, stock prices start declining accordingly. Going by the same theory, Fama’s hypothesis also suggests that the negative relationship between stock returns and inflation is the outcome of the negative relations between inflation and real activity.

Fama (1981) and Kaul (1987) suggest that if future output growth is accounted for in the stock return regressions, inflation becomes insignificant. Geske and Roll (1983) reverse the causality relationship by Fama by suggesting that rational stock investors predict decreasing real growth, which has an impact on monetary policy. Accordingly, when stock prices decrease, it provides a signal for a higher upcoming inflation. On the other hand, Modigliani and Cohn (1979) explain that the negative relationship between unexpected inflation and stock returns is a result of the mispricing, which is driven by the inflation illusion in the short-run. After that, the inflation illusion should diminish on the long-run (Campbell and Vuolteenaho, 2004). Therefore, Modigliani and Cohn’s theory is against the theory of Geske and Roll concerning rational investor decisions. Another argument by Malkiel (1979) and Pindyck (1984) suggests that with high inflation comes economic uncertainty, which will lead to a risk premium for stocks (inflation/uncertainty premium).

Another different result is shown by Bekaert and Wang’s study (2010) which analyzed 45 countries over 40 years. Although stock returns appeared as hedge against inflation for equities in emerging markets, the overall conclusions was that equities were poor hedges of inflation risk over the short and long term.

In order to make the relationship more defined, some authors have limited their research by certain industries. Boudoukh et al. (1994) found in their study that non-cyclical industries such as food and beverage provide a better inflation hedge more than the cyclical industries. However, their results included very low significance levels and were applicable to investment horizons of
Some studies focus on the inflation hedging heterogeneity of individual stocks. In a study by Ang et al. (2012), the results show that good inflation hedges are often found in the oil, gas, and technology sectors.

2.2 The Effect of Unexpected Inflation on Stock Returns

Unexpected or unanticipated inflation is the difference between expected inflation and realized inflation. It is considered a surprise factor and the main reason behind distortions and wealth transfers in society (Mankiw, 2001). The magnitude of the unanticipated inflation depends on investor expectations. Due to the risk that the unexpected causes for investors, inflation hedging mechanisms are highly needed over a short and long run horizon. Accordingly many authors, tackled the topic in their studies and there are various theories and models, which explain the relationship between unexpected inflation and stock returns. Adding to Fisher’s original hypothesis and ex-post version, Fama and Schwert have made an extension to include unanticipated inflation in the framework.

2.2.1 The Fama and Schwert (1977) Framework

The Fisher hypothesis and the ex-post version have included realized or expected inflation in their framework. Thus, Fama and Schwert (1977) have created the following model to include unexpected inflation:

\[ r_n = \alpha + \beta E(\pi) + \gamma (\pi - E(\pi)) + \epsilon \]  

(3)

In equation (3), the unexpected inflation, \((\pi - E(\pi))\), is the inflation minus the expected inflation. The expected inflation, \(E(\pi)\), is represented as last period’s inflation. An asset would be considered a complete hedge for expected inflation if \(\beta\) equals one, and a complete hedge for unexpected inflation if \(\gamma\) equals one. Also, if \(0 < \beta < 1\) and \(0 < \gamma < 1\), an asset would be considered a partial hedge and if the values of \(\beta\) and \(\gamma\) are negative, it would be considered a perverse hedge. Many studies have used Fama and Schwert’s framework and have taken various proxies for expected inflation including surveys. Those studies were mostly over a short-term horizon, as many studies analyzing long-term horizons used the realized inflation term due to the difficulty of anticipating future inflation (Rodel, 2012).
2.2.2 Other Research on Unexpected Inflation and Stock Returns

A model that explains the relationship between unexpected inflation and stock returns is the theoretical model built by Veronesi (1999). The theoretical equilibrium model by Veronesi states that the economy’s recent state and economic condition may have an effect on the investor’s response to new information. Thus, if the new information is going against the recent market direction, investors will feel more uncertain about the market and they will accordingly discount new information at a higher rate.

Previous papers which used the Veronesi (1999) model studied how the market conditions affect the investor response to new information. Investor response to new information regarding the unemployment rate, the dividend change, and the inflation rate was respectively analyzed by Boyd et al. (2005), Docking and Koch (2005), and Knif et al. (2008). The observations from those studies reveal that the impact varies according to the state of the business cycle.

In a more specific approach than Veronesi, Diaz and Jareno (2012), analyze the relationship between unexpected inflation and stock returns based on the sector of activity. In Diaz and Jareno’s study, the sectors were divided according to their ability to pass on the inflation shocks to their output prices. Moreover, Estep and Hanson (1980) proposed that the relationship between unexpected inflation and stock returns could even be neutral depending on a firm’s ability to pass-on the inflation shocks to the prices of products or services. Thus, unexpected inflation could have a neutral effect on stock returns if the effects could be transferred to customers.

Fischer’s (1993) policy hypothesis suggests that investors build their monetary policy predictions depending on whether the current inflation outturns met their expectations or not. In other words, they will predict whether the monetary policy will be tightened or loosened depending on their anticipation of future inflation levels. For example, investors in the market will anticipate higher or lower real interest rates in the market depending on their expectations of the current inflation outturn.
Other studies have concluded that unexpected inflation will result in an economic cost as it increases inflation uncertainty (Evans and Wachtel, 1993; Huizinga, 1993; Holland, 1995). In addition, unexpected inflation increases the variability of relative prices. The issue with unexpected inflation is that it reduces the role of the price system in guiding market activity and raises the cost of assimilating information (Friedman, 1976). Another cost which results from unexpected inflation is the high cost of price adjustment. Thus, the aforementioned factors would lead to a negative relationship between unexpected inflation and stock returns.

In a study by Schwert (1981), the reaction of stock prices to new information about inflation was analyzed. The returns used in the study were daily returns from Standard and Poor’s composite portfolio. The results showed that the stock market reacts negatively to the announcement of unexpected inflation in the CPI. However, the reaction’s magnitude is weak. Fama (1979) suggests why the stock market’s reaction to unexpected inflation is small. According to Fama (1979), changes in inflation or unexpected inflation are “contemporaneously correlated” with unexpected changes in other ‘real’ economic including capital expenditures and Gross National Product (GNP). Therefore, the effect of unexpected inflation on stock returns might be spurious. (Schwert, 1981).

Another study by Adams et al. (2004), reveals that inflation surprises do impact stock returns. There is a negative relationship between unexpected inflation and stock returns. When there are unexpected increases in the CPI, stock prices fall. The study also shows that the response of stocks to unexpected inflation happens in about 10-20 minutes. “This non-instantaneous response is primarily due to non-trading in the first few minutes of the day.” (Adams et al., 2004). In addition, according to the study, the stock-inflation relationship is dependent on many factors such as the stock’s size, economy’s strength, and type of inflation news.

2.3 The Impact of the Control Variables on Inflation and Stock Returns

The control variables used in the thesis are oil prices, Dow Jones Global Index (DJGI), and the discount rate. With regards to oil prices, previous studies have shown that they have a direct and indirect impact on inflation. The effect could be direct to consumers, as they will be paying a higher price for energy consumption. As for the indirect effect, it works through the supply side. It could occur due to the fact that oil is also used as an input product in many
activities. Therefore, suppliers will raise the end-good due to a rise in the price of inputs. Empirical studies suggest that there is a pass-through of the rise in oil prices to consumers. The increase in energy prices will cause higher expectations of wages. Consequently, if workers demand higher wages to compensate for the decline in their real income, it may lead to an increase in cost-push inflation. Also, in the United States, studies have shown that oil prices affect macro-economic variables significantly (Gisser and Goodwin, 1986). Moreover, the oil shocks of 1973 and 1979 have contributed significantly in an increase in the price level in developing countries (Burbidge and Harrison, 1984).

For the DJGI, it was used as a benchmark to test how the global stock market affects the stock markets in the MENA region. The DJGI is comprised of 47 countries, 25 developed markets including (Australia, Germany, Netherlands, and Sweden) and 22 emerging markets including (Brazil, India, and Russia). The financial crisis of 2007 – 2009, which happened in the United States as a result of the subprime mortgage market, has caused spill-over effects over many other countries both advanced and emerging. The crisis has shown how there is a huge equity market contagion (Bekaert et al., 2014). There is a large body of literature which supports global equity contagion. A study by Abou-Zaid (2011) shows that Egypt is significantly influenced by the U.S stock market, for example. Also, the “wake-up call hypothesis”, states that when a crisis happens in one country, it pushes investors to reassess the market weaknesses in other countries or market segments (Goldstein (1998), Masson (1999), Goldstein, Kaminsky, and Reinhart (2000)). Under the aforementioned hypothesis, the degree of contagion depends on the strength of the other countries’ local fundamentals and institutional factors. Moreover, contagion could be driven by the degree of investor’s risk appetite or by the herding behavior (Bekaert et al., 2014). That is why in this study we chose the DJGI in order to test the level of global contagion and interdependence of equity markets and to study the effect of such contagion on equity markets in the MENA region.

As for the discount rate, the literature states that since the discount rate changes contain “announcements effects” about the course of future monetary policy, they affect security prices. The empirical evidence for this theory is provided by Baker and Meyer (1980), and Brown (1981), who revealed in their studies a significant announcement effects of discount rate changes on a variety of securities. Another study by Yawtiz and Smirlock (1985) shows that discount rate changes only have an impact when changes are non-technical, or contain news about future
monetary policy. If the discount rate changes are non-technical, they had a negative impact on stock returns. The results also show that the market adjustment occurs by the end of the announcement day, confirming the efficient market hypothesis theory. As for the technical changes, which carry no news or announcements, there was no stock market reaction.

2.4 Inflation and Stock Returns in the MENA region

2.4.1 Egypt

Maintaining a stable inflation is one of the main priorities of the Government of Egypt (GoE) and the Central Bank of Egypt (CBE). Despite the efforts by the GoE and the CBE to curb inflation, the flotation of the Egyptian pound in November 2016 and the hiking of fuel prices, caused headline inflation to surge to an 8 year high of 19.4%, as reported by Central Agency for Public Mobilization and Statistics (CAPMAS). The flotation was part of a set of reforms set by the International Monetary Fund (IMF) for Egypt in order to secure a USD 12 billion 3-year loan. Apart from the negative effects that inflation will have on Egyptians’ real incomes, the stock returns of investors are also expected to be affected. However, the CBE now has a better balance between reducing inflationary pressures and enhancing growth without having to focus on maintaining a steady exchange rate after the pound’s flotation. The inflation rate in Egypt averaged 9.04% from 1958 until 2016, reaching an all time high of 35.10% in June of 1986 and a record low of -4.20% in August of 1962.

A study conducted by Omran and Pointon in 2001, reveals that inflation rate in Egypt has an impact on stock market performance in terms of market activity and market liquidity. The results from this study indicate that the relationship between inflation and market activity and liquidity is negative. Omran and Pointon’s study results are consistent with the literature view that there is an inverse relationship between the inflation rate and both stock returns and prices (Omran and Pointon, 2001). Also, another study by Al-Rjoub (2005) reveals that unexpected inflation has a high and significant negative impact on stock returns in Egypt.

2.4.2 Jordan

Consumer prices in Jordan have increased 0.8% year-on-year (y-o-y) in December of 2016, after a 0.5% rise in the previous month. This was considered the highest inflation rate
since January 2015. The rise in prices was due to an increase in the prices of transport, housing and utilities, and housing appliances and equipment. The average rate of inflation is 5.35% from the year 1977 until 2016. An all-time high inflation rate of 32.91% was reached in August of 1989 and a record low of -8.28% in December of 1994. In Jordan, unexpected inflation has a significant and negative impact on stock market returns (Al-Rjoub, 2005). Another study by Al-Zoubi and Al-Sharkas (2011) shows that there is a long-run positive relationship between stock prices and inflation.

2.4.3 Kuwait

The current inflation rate in Kuwait stands at 3.51%. In the historical literature, there has not been a sufficient amount of studies explaining in depth the relationship between inflation and stock returns in Kuwait. On a general level, the relationship between macro-economic variables and stock returns in the Gulf Council Countries (GCC), has produced inconclusive results. (See Al Batel (1999) and Bashir and Hassan (1997)). However, a study by Abdallah Al Mutairi and Husain Al Omar (2007) shows that among several macro-economic variables examined in their study, government expenditure and inflation have the highest effect on stock returns. Also, in a study which examined the effect of inflation on stock returns in Kuwait, Morocco, Jordan, and Saudi Arabia, Kuwait was the only country with Fisher effect coefficient estimates which are significantly greater than one (Al-Zoubi and Al-Sharkas, 2011).

2.4.4 Morocco

Consumer Prices in Morocco increased 1.8% y-o-y in December of 2016. The cost increased at a slower pace for food and declined less for communication. Concerning transport, prices rose faster and increased at the same pace for housing and utilities and education. Inflation Rate in Morocco averaged 1.48% from 2008 until 2016, reaching an all-time high of 5.20% in May of 2008 and a record low of -1.60% in December of 2009. According to Al-Zoubi and Al-Sharkas (2011), stock returns in Morocco provide a long-run hedge against inflation.

2.4.5 Qatar

One of the main goals of the Qatar Central Bank is to preserve money value and assure monetary stability. Consumer prices rose in Qatar by 1.2% (y-o-y) in January 2017. This was
considered the lowest inflation rate since January 2016, as the cost of food and non-alcoholic beverages continued to decrease. The average rate of inflation was 3.36% from 2005 until 2016. The inflation rate in Qatar reached an all time high of 16.59% in June 2008 and a record low of -9.96% in December 2009. In a study by Al Khazali (2003) of 21 markets including Qatar, the results showed that in the short-run there is a negative relationship between inflation and stock returns, even after incorporating the effects of expected economic activity and inflation variability. However, the findings are consistent with the Fisher hypothesis in the long-run.

2.4.6 UAE

Consumer prices in the UAE have increased 2.6% (y-o-y) in November 2016. The main reason behind the increase in prices was the increase in prices of food, transport, and housing. The average inflation rate in the UAE was 2.18% from 1990 until 2016. It reached an all time high of 12.30% in December 2008 and a record low of -0.40% in October 2009. In the findings of Al-Tamimi and Abdel Rahman (2011) and other similar studies, inflation has an inverse relationship with stock prices in the UAE.

2.4.7 Tunisia

The inflation rate in Tunisia was recorded at 4.2% in December of 2016. Inflation Rate in Tunisia averaged 5.21% from 1963 until 2017. It reached an all-time high of 16.70% in July of 1982 and a record low of -1.40% in June of 1970. Inflation and stock returns in Tunis have a negative relationship in the short-run and positive relationship in the long-run (Al Khazali, 2003).

2.4.8 Saudi Arabia

The inflation rate in Saudi Arabia was recorded at 2.3% in December 2016. The average inflation rate reached 2.8% from 2000 until 2016, reaching an all time high of 11.10% in July of 2008 and a record low of -2% in January of 2001. Stock returns provide a long-run hedge from inflation with long-run Fisher elasticity of stock prices with respect to goods prices of 1.20 (Tamimi and Abdel Rahman, 2011).
3. Data

We employ monthly data to analyze the linkages between stock prices and CPIs. Our sample includes eight MENA countries from the period January 2005 to December 2016; a sample of 144 observations. The reason behind choosing monthly data is the importance of examining the month on month inflation, especially after economic shocks. Our original intention in this study was to include all MENA countries. However, due to data limitations, we have chosen the following countries: Egypt, Jordan, Kuwait, Morocco, Qatar, UAE, Tunisia, and Saudi Arabia. The data was extracted from two sources: Datastream and Eikon. We denote $R_{st}$ and $U_{It}$ as the returns of stock indices and unexpected inflation, respectively. The summary statistics are displayed in Table 1.

3.1 Independent Variable

In this study, the independent variable is the unexpected inflation, which will be modeled by using ARMA model (e.g. Schwert 1981, and Pearce and Roley 1988). The ARMA $(p, q)$ model forecasts unexpected inflation at period $t$ as the linear projection of (i) inflation from period $t-1$ to $t-p$, autoregressive (AR) part, and (ii) white noise from period $t$ to $t-q$, moving average (MA) part, given that inflation is stationary (equation (4)).

$$\pi_t = \beta_0 + \sum_{i=1}^{p} \beta_i \pi_{t-i} + \epsilon_t + \sum_{j=1}^{q} \theta_j \epsilon_{t-j} \tag{4}$$

To identify the most suitable ARMA order to forecast unexpected inflation, we use the LM serial correlation test. The number of lags is chosen by starting from the log and increasing it until the errors become white noise.

3.2 Dependent Variable

The dependent variable is the stock prices. As a proxy for stock prices, we use major stock indices for the examined countries. For example, Egypt; Egyptian Exchange (EGX 30), Jordan; Jordan Amman Stock Exchange (ASE) General Index, Kuwait; Kuwait 15 Index (KSX 15), Morocco; Casablanca All Share Index, Qatar; Qatar Exchange General Index, UAE; Abu Dhabi Securities Main General Index and Dubai; Dubai Financial Market General Index
(DFMGI), Tunisia; Tunis Index 20, Saudi Arabia; Saudi Index (Tadawul). For each country’s return, its domestic currency was used.

3.3 **Control Variables**

In terms of control variables, we use variables found to be important in the literature on stock returns. The control variables used were the Dow Jones Global Index (DJGI), World Oil Prices (Ice Brent Crude), Discount Rate (%), and the Consumer Price Index (CPI).
### 3.4 Descriptive Statistics

#### Table 1
Summary of Descriptive Statistics for Indices and CPIs

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Variable</th>
<th>EGP</th>
<th>JOR</th>
<th>KUW</th>
<th>MOR</th>
<th>QAT</th>
<th>DUBAI</th>
<th>ABU DHABI</th>
<th>TUNIS</th>
<th>SAUDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>Indices</td>
<td>6742.5849</td>
<td>2695.6266</td>
<td>1008.0718</td>
<td>10051.4953</td>
<td>9183.6365</td>
<td>3377.6811</td>
<td>3702.4706</td>
<td>2046.5731</td>
<td>8278.6631</td>
</tr>
<tr>
<td></td>
<td>CPI</td>
<td>0.0091</td>
<td>0.0032</td>
<td>0.0034</td>
<td>0.0013</td>
<td>0.0012</td>
<td>0.0015</td>
<td>0.0015</td>
<td>0.0036</td>
<td>0.0031</td>
</tr>
<tr>
<td>Standard Error</td>
<td>Indices</td>
<td>159.7053</td>
<td>68.6668</td>
<td>15.7668</td>
<td>187.1921</td>
<td>168.2474</td>
<td>141.2039</td>
<td>83.0306</td>
<td>26.8177</td>
<td>232.1435</td>
</tr>
<tr>
<td></td>
<td>CPI</td>
<td>0.0002</td>
<td>0.0002</td>
<td>0.0002</td>
<td>0.0001</td>
<td>0.0002</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0002</td>
</tr>
<tr>
<td>Median</td>
<td>Indices</td>
<td>6586.0000</td>
<td>2279.0950</td>
<td>1026.1800</td>
<td>10107.0600</td>
<td>8763.0000</td>
<td>3354.4200</td>
<td>1990.3700</td>
<td>1990.3700</td>
<td>7431.3200</td>
</tr>
<tr>
<td></td>
<td>CPI</td>
<td>0.0094</td>
<td>0.0032</td>
<td>0.0021</td>
<td>0.0013</td>
<td>0.0013</td>
<td>0.0014</td>
<td>0.0036</td>
<td>0.0029</td>
<td>0.0094</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>Indices</td>
<td>1909.7979</td>
<td>824.0027</td>
<td>117.9883</td>
<td>2246.3049</td>
<td>2018.9684</td>
<td>1694.4464</td>
<td>996.3683</td>
<td>205.9912</td>
<td>2785.7223</td>
</tr>
<tr>
<td></td>
<td>CPI</td>
<td>0.002</td>
<td>0.002</td>
<td>0.003</td>
<td>0.001</td>
<td>0.002</td>
<td>0.002</td>
<td>0.001</td>
<td>0.002</td>
<td>0.002</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>Indices</td>
<td>0.0655</td>
<td>-0.1048</td>
<td>-0.8997</td>
<td>0.5825</td>
<td>-0.5529</td>
<td>-0.1772</td>
<td>-1.2066</td>
<td>-1.4912</td>
<td>3.6284</td>
</tr>
<tr>
<td></td>
<td>CPI</td>
<td>-0.7739</td>
<td>-1.1441</td>
<td>-1.1668</td>
<td>-0.6700</td>
<td>-1.3158</td>
<td>-0.3986</td>
<td>-0.3986</td>
<td>-1.1554</td>
<td>-1.3440</td>
</tr>
<tr>
<td>Skewness</td>
<td>Indices</td>
<td>0.6604</td>
<td>1.0686</td>
<td>-0.1908</td>
<td>-0.6057</td>
<td>0.2295</td>
<td>0.6800</td>
<td>0.2634</td>
<td>0.2607</td>
<td>1.7883</td>
</tr>
<tr>
<td></td>
<td>CPI</td>
<td>0.4069</td>
<td>-0.4224</td>
<td>-0.2653</td>
<td>-0.2095</td>
<td>0.3240</td>
<td>0.6225</td>
<td>0.6225</td>
<td>0.2912</td>
<td>-0.2129</td>
</tr>
<tr>
<td>Count</td>
<td>Indices</td>
<td>143</td>
<td>144</td>
<td>56</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>59</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CPI</td>
<td>144</td>
<td>144</td>
<td>120</td>
<td>96</td>
<td>107</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td>JB</td>
<td>Indices</td>
<td>10.3295***</td>
<td>26.9559***</td>
<td>34.7442***</td>
<td>10.2527**</td>
<td>3.2238</td>
<td>12.7826***</td>
<td>11.3916**</td>
<td>5.9308**</td>
<td>147.0768***</td>
</tr>
</tbody>
</table>

JB is the Jarque–Bera test for normality.

*** Significance at 1%
**  Significance at 5%
*   Significance at 10%

As shown in table (1), all the indices of all MENA region countries in our sample are positively skewed except for Kuwait and Morocco. Also, the CPIs all show a positive skewness except for Jordan, Kuwait, and Morocco. Moreover, the JB test for normality results reveal that there is a significance in all countries for CPIs and Indices except in two countries: Morocco and Qatar. In Morocco, there is no significance in CPI, and in Qatar there is no significance in the indices. As for the variability of the indices, there is a high variability, as indicated by the standard deviation.
4. Model and Methodology

This study investigates the relationship between unexpected inflation and stock prices in 8 MENA countries: Egypt, Jordan, Kuwait, Morocco, Qatar, UAE, Tunisia, and Saudi Arabia using the VECH-GARCH Model. In the countries where stock prices and inflation are co-integrated, we use the Error Correction Model (ECM) of Johansen (1995). We also include some control variables to capture the effect of monetary policy changes and global oil and stock market shocks. We then estimate the model using VECH-GARCH developed by Engle and Kroner (1995) to examine the volatility behavior of stock prices and inflation.

4.1 Estimating Unexpected Inflation

In order to estimate the unexpected inflation, the expected inflation should be forecasted first. As explained in section 2.1.4, previous studies have used various methodologies to estimate expected inflation. As aforementioned, several authors used simple time series Auto Regressive Integrated Moving Average (ARIMA) models to estimate the expected inflation component and then used the forecast errors of the ARIMA models estimate the unexpected inflation. Similarly, we use the ARMA model to estimate unexpected inflation. To identify the most suitable order of the ARMA (p,q) model, we use the LM serial correlation test. The number of lags is selected by starting from the log and increasing it until the errors become white noise. According to the LM serial correlation test, the most suitable order of the ARMA model to forecast unexpected inflation is ARMA (4, 4).

4.2 The Conditional Mean - Testing the Relationship between Unexpected Inflation and Stock Returns

After estimating the unexpected inflation, we test the relationship between unexpected inflation and stock returns using Ordinary Least Squares (OLS) with the following model:

\[
R_{st} = \alpha_i + \sum_{j=1}^{n} \beta_j \cdot U_{ft}^{t-j} + \sum_{j=1}^{n} \beta_j \cdot s_{xt} \cdot R_{st-j} + \delta_i \cdot R_{oil,t} + v_i \cdot R_{dr,t} + \omega_i \cdot R_{dj,t} + \epsilon_{st} \quad (5)
\]

\[
U_{ft} = \alpha_i + \sum_{j=1}^{n} \beta_j \cdot U_{ff}^{t-j} + \sum_{j=1}^{n} \beta_j \cdot s_{ff} \cdot R_{st-j} + \delta_i \cdot R_{oil,t} + v_i \cdot R_{dr,t} + \omega_i \cdot R_{dj,t} + \epsilon_{ft} \quad (6)
\]

\footnote{The difference between ARMA and ARIMA models is that an integrated autoregressive process is one whose characteristic equation has a root on the unit circle.}
In equations (5) and (6), $R_{st}$ and $U_{It}$ are the return on stock market index at time $t$, and the unexpected inflation at $t$ in each of the examined countries respectively. $\varepsilon_{st}$ and $\varepsilon_{If_t}$ are the innovation to stock return equation and unexpected inflation equation respectively. $\alpha_i$ stands for the intercept of the stock return equation and unexpected inflation equation respectively ($i = S$ and $If$ respectively). $\beta_{js_s}$ and $\beta_{If_if}$ measure respectively the responses of stock market returns and unexpected inflation changes to their own lags (where lags $j = 1$ to $n$). The lag length is selected using the Akaike Information Criterion (AIC), and in most cases a lag length $j = 1$ is sufficient to capture the dynamics associated with financial returns.

While $\beta_{If_if}$ and $\beta_{js_s}$ measure the cross effect of unexpected inflation on stock returns. These two coefficients measure any causality between unexpected inflation and stock returns, or the mean spillover between stock returns and unexpected inflation. We include three control variables following Caporale et al. (2014) and Fama and Schwert (1977): $R_{oil,t}$, $R_{dr,t}$, $R_{dj,t}$: the effect of oil supply shock represented by the return of Ice Brent Crude, the effect of monetary policy changes represented by the discount rate, and the effect of external financial shocks represented by return on Dow Jones Global Index (DJGI), respectively. The use of world oil prices as a supply shock is supported by Amano and van Norden (1998) who showed that world oil price movements can capture the underlying shocks to the terms of trade.

4.3 Employing the ECM

To test for co-integration between CPIs and stock prices, we used the Johansen (1995) trace test. Prior to testing the co-integration between the CPIs and stock prices, we used the Augmented Dickey—Fuller (ADF) on the CPIs and stock prices of all countries to test whether the variables have a unit root. After testing for all countries, the ADF showed that the both variables are non-stationary, as shown in Appendix 2. At first, we implemented the ADF on stock returns and inflation but the results revealed that they were all stationary and therefore we tested for stationarity on CPIs and stock prices.

In case the Johansen (1995) trace test detected co-integration, we augment equation (5) and (6) by an error correction term ($ect_{t-1}$) as in Caporale et al. (2014) and Li, Ling and Wong (2001).
\[ R_{st} = \alpha_i + \sum_{j=1}^{n} \beta_{j} U_{lf_{t-j}} + \sum_{j=1}^{n} \beta_{j_s} R_{st-j} + \delta_i R_{oil_t} + \nu_i R_{dr,t} + \omega_i R_{dj,t} + \phi_i e_{ct_{t-1}} + \epsilon_{st}(7) \]

\[ U_{lf_t} = \alpha_i + \sum_{j=1}^{n} \beta_{j} U_{lf_{t-j}} + \sum_{j=1}^{n} \beta_{j_s} R_{st-j} + \delta_i R_{oil_t} + \nu_i R_{dr,t} + \omega_i R_{dj,t} + \phi_i e_{ct_{t-1}} + \epsilon_{lf_t}(8) \]

Where \( e_{ct_{t-1}} \) is equals to \( \phi_i( P_{t-1} - \gamma_i CPI_t-1) \)

\[ R_{st} = \alpha_i + \sum_{j=1}^{n} \beta_{j} U_{lf_{t-j}} + \sum_{j=1}^{n} \beta_{j_s} R_{st-j} + \delta_i R_{oil_t} + \nu_i R_{dr,t} + \omega_i R_{dj,t} + \phi_i( P_{t-1} - \gamma_i CPI_t-1) + \epsilon_{st}(7) \]

\[ U_{lf_t} = \alpha_i + \sum_{j=1}^{n} \beta_{j} U_{lf_{t-j}} + \sum_{j=1}^{n} \beta_{j_s} R_{st-j} + \delta_i R_{oil_t} + \nu_i R_{dr,t} + \omega_i R_{dj,t} + \phi_i( P_{t-1} - \gamma_i CPI_t-1) + \epsilon_{lf_t}(8) \]

Where \( P \) is the log of stock market index, \( CPI \) is the consumer price index and \( \phi_i \) is the error correction coefficient, (i stands for the stock return and unexpected inflation in each respective equation).

### 4.4 Volatility Model

After employing the ECM on the countries, which have a co-integrated relationship between CPIs and stock market prices, we use a multivariate VECH-GARCH to capture the joint volatility dynamics between stock return and inflation. The literature presents several GARCH specifications in modeling volatility. The reason we chose VECH-GARCH is for its ability to dynamically estimate the volatility relation between stock market returns and inflation by allowing a time varying covariance matrix without falling in the trap of the curse of dimensionality (Engle and Kroner, 1995). The model is presented as follows:

Let \( H_t \) be variance covariance matrix.

Then, \( \text{vech}(H_t) = \Omega + \sum_{j=1}^{n} A \text{vech}(\epsilon_{t-i}, \epsilon_{t-i}) + \sum_{j=1}^{n} B \text{vech}(H_{t-j}) \)
\[
\begin{bmatrix}
    h_{ss} \\
    h_{sIf} \\
    h_{IfIf}
\end{bmatrix} = \begin{bmatrix}
    \Omega_1 \\
    \Omega_2 \\
    \Omega_3
\end{bmatrix} + \begin{bmatrix}
    a_{ss} & 0 & 0 \\
    0 & a_{sIf} & 0 \\
    0 & 0 & a_{IfIf}
\end{bmatrix} \begin{bmatrix}
    \varepsilon_{ss,t-1}^2 \\
    \varepsilon_{sIf,t-1}^2 \\
    \varepsilon_{IfIf,t-1}^2
\end{bmatrix} + \begin{bmatrix}
    b_{ss} & 0 & 0 \\
    0 & b_{sIf} & 0 \\
    0 & 0 & b_{IfIf}
\end{bmatrix} \begin{bmatrix}
    h_{ss,t-1} \\
    h_{sIf,t-1} \\
    h_{IfIf,t-1}
\end{bmatrix}
\] (9)

Where \( \Omega \) is a vector of constants, \( A^* \) and \( B^* \) are \( N \) by \( N \) matrix of parameters. \( A^* \) captures the news effect on dynamic covariance. \( B^* \) captures memory effect; the effect of past covariance on current covariance. We restrict the off-diagonal parameters to be zero. This specification has the advantage of dynamically estimating the covariance without being subject to the curse of dimensionality. Therefore, the conditional variance of stock prices and CPIs is modeled as a function of lagged conditional variance (\( b_{ss}, b_{IfIf} \)) and lagged innovation (\( a_{ss}, a_{IfIf} \)). Dynamic covariance of the stock market returns and inflation is captured via \( a_{sIf} \) and \( b_{sfx} \).

5. Empirical Results

5.1 Testing for Long-run Relation between CPI and Stock Market Prices

The first test applied in this study is the co-integration test for CPIs and stock market prices. The results of the Johansen trace test presented in Table 2 indicate evidence of co-integration relation between CPIs and stock market prices in two of the eight examined countries: Egypt and Jordan. The null hypothesis of no co-integration was not rejected in the case of Kuwait, Morocco, Qatar, UAE, Tunisia, and Saudi Arabia.

Table 3

Results of the Johansen’s co-integration tests between CPIs and the stock market prices.

<table>
<thead>
<tr>
<th>Country</th>
<th>( r )</th>
<th>( \text{Eigenvalues} )</th>
<th>Trace-test</th>
<th>( p )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td>( r = 0 )</td>
<td>0.1578</td>
<td>31.627</td>
<td>0.0001***</td>
</tr>
<tr>
<td></td>
<td>( r \leq 1 )</td>
<td>0.0638</td>
<td>8.7814</td>
<td>0.0030**</td>
</tr>
<tr>
<td>Jordan</td>
<td>( r = 0 )</td>
<td>0.1211</td>
<td>15.4947</td>
<td>0.0025**</td>
</tr>
<tr>
<td></td>
<td>( r \leq 1 )</td>
<td>0.0389</td>
<td>3.8414</td>
<td>0.0187</td>
</tr>
<tr>
<td>Kuwait</td>
<td>( r = 0 )</td>
<td>0.1036</td>
<td>6.0564</td>
<td>0.6889</td>
</tr>
<tr>
<td></td>
<td>( r \leq 1 )</td>
<td>0.0092</td>
<td>0.4736</td>
<td>0.4913</td>
</tr>
<tr>
<td>Morocco</td>
<td>( r = 0 )</td>
<td>0.0726</td>
<td>10.1693</td>
<td>10.1693</td>
</tr>
<tr>
<td></td>
<td>( r \leq 1 )</td>
<td>0.0129</td>
<td>1.4956</td>
<td>1.4956</td>
</tr>
<tr>
<td>Qatar</td>
<td>( r = 0 )</td>
<td>0.0758</td>
<td>7.5322</td>
<td>0.5167</td>
</tr>
<tr>
<td></td>
<td>( r \leq 1 )</td>
<td>0.0038</td>
<td>0.3520</td>
<td>0.5530</td>
</tr>
</tbody>
</table>
The table reports the Johansen trace statistics (Johansen 1995). $r$ is the cointegration rank. The lag length is selected using the Akaike Information Criterion (AIC), subject to correction for serial correlation by the inclusion of further lags. The last column reports the respective p-values.

<table>
<thead>
<tr>
<th>Country</th>
<th>$r = 0$</th>
<th>$r \leq 1$</th>
<th>$r = 0$</th>
<th>$r \leq 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>UAE (Dubai)</td>
<td>0.0998</td>
<td>12.2028</td>
<td>0.1475</td>
<td></td>
</tr>
<tr>
<td>UAE (Abu Dhabi)</td>
<td>0.0143</td>
<td>1.4702</td>
<td>0.2253</td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td>0.0876</td>
<td>10.9539</td>
<td>0.2143</td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td>0.0155</td>
<td>1.6010</td>
<td>0.2058</td>
<td></td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>0.1437</td>
<td>9.4735</td>
<td>0.3234</td>
<td></td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>0.0200</td>
<td>1.0949</td>
<td>0.2954</td>
<td></td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>0.0716</td>
<td>12.8769</td>
<td>0.1194</td>
<td></td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>0.0180</td>
<td>2.5363</td>
<td>0.1112</td>
<td></td>
</tr>
</tbody>
</table>

The results suggest that the main reason behind the existence of a long-run relationship between unexpected inflation and stock returns in Egypt and Jordan is their similar fiscal and monetary policies. For Jordan, the CBJ aims at maintaining an appropriate inflation rate and a stable exchange rate that ensures the convertibility of the Jordanian Dinar (JD). The JD is pegged to the U.S Dollar since 1995. Therefore, changes in the foreign exchange in Jordan could cause unexpected inflation changes which affect stock returns negatively, as shown in the results. As for the inflation rate, it has accelerated to 2.5% (y-o-y) in January to 4.6% (y-o-y) in February, as

5.2 VECM Results

The Johansen co-integration test shows that there is a long-run relationship in Egypt and Jordan only. Accordingly, the error correction term is added for the countries where co-integration was detected. As shown in Tables 4.1 and 4.2, the ECM was added to Egypt and Jordan. The lagged error correction term (ECM), allows us to capture the long-run causality between unexpected inflation and stock returns. In Jordan, the lagged error correction $ect_{t-1}$ coefficient is significant and negative for the stock returns equation, implying that the adjustment takes place through stock returns and implying causality from unexpected inflation to stock returns in the long-run. Also, the lagged $ect_{t-1}$ coefficient in the stock returns equation is small indicating a slow adjustment to long run equilibrium. In Egypt, the error correction coefficient in both the unexpected inflation and stock return equations is insignificant. In other words, there is no significant or causal relationship between unexpected inflation and stock returns in Egypt.
a result of the higher global food prices and the one-off impact of fiscal measures taken by the Government. The fiscal measures are part of the IMF’s reform plan to Jordan under the three year Extended Fund Facility. The measures include preserving macro-economic stability by keeping international reserves at adequate levels and putting public debt on a downward path. Anchored by Jordan’s currency peg, which has served the economy well, the authorities’ program aims at preserving macroeconomic stability by keeping international reserves at suitable levels, while also putting public debt on a downward path. The program intends to address structural fiscal challenges by widening the tax base, preserving prudent growth of spending, and enhancing tax administration.

A similar economic situation also exists in Egypt. Despite of the long-run relationship between unexpected inflation and stock returns, the lack of significance between the two variables suggests that other variables, such as the exchange rate, play an important role in stock return changes. Similar to Jordan, sudden or unexpected changes in unexpected inflation could cause changes in stock returns. Adding to the sudden economic changes in the economy, Egypt has abandoned its currency peg and moved to a floating exchange regime in order to secure the USD 12 billion 3 year loan from the IMF. Following the flotation, headline inflation soared to an 8 year high of 19.4%. In addition, the EGX 30 returns have increased by 37% from October 2016 to November 2016 and there was an increase by 8% from November 2016 to December 2016. This shows that the sudden shocks in Egypt’s economy have caused a short-term monthly surge in the stock returns, which is expected to diminish over the long run.
Table 4.1  
The VECM for Egypt

<table>
<thead>
<tr>
<th></th>
<th>$R_i$ ($i = S$)</th>
<th>$U_i$ ($i = If$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a_i$</td>
<td>0.1880</td>
<td>0.0062</td>
</tr>
<tr>
<td></td>
<td>(0.1983)</td>
<td>(0.1964)</td>
</tr>
<tr>
<td>$b_i$</td>
<td>-8.0451</td>
<td>0.0051</td>
</tr>
<tr>
<td></td>
<td>(5.3262)</td>
<td>(0.0618)</td>
</tr>
<tr>
<td>$b_{0i}$</td>
<td>0.4440</td>
<td>0.0004</td>
</tr>
<tr>
<td></td>
<td>(5.3245)</td>
<td>(0.0593)</td>
</tr>
<tr>
<td>$\delta_i$</td>
<td>-0.0041</td>
<td>-0.0001</td>
</tr>
<tr>
<td></td>
<td>(0.0739)</td>
<td>(0.0711)</td>
</tr>
<tr>
<td>$\gamma_i$</td>
<td>0.0134**</td>
<td>-0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0047)</td>
<td>(0.0044)</td>
</tr>
<tr>
<td>$\omega_i$</td>
<td>1.2620***</td>
<td>0.0013</td>
</tr>
<tr>
<td></td>
<td>(0.1277)</td>
<td>(0.1229)</td>
</tr>
<tr>
<td>$\phi_i$</td>
<td>-0.0198</td>
<td>-0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0199)</td>
<td>(0.0167)</td>
</tr>
<tr>
<td>$\psi_i$</td>
<td>-0.6342</td>
<td>-0.6342</td>
</tr>
<tr>
<td></td>
<td>(1.2295)</td>
<td>(1.2295)</td>
</tr>
</tbody>
</table>

$R_i$ and $U_i$ indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in the parentheses (.). Where $S$ is the stock return equation, and $If$ is the unexpected inflation equation. $P$ represents the Egyptian stock market index, and CPI represents Egyptian Consumer Price Index. The equation is specified as:

$$R_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} R_{it-j} + \sum_{j=1}^{n} \beta_{ij} R_{it-j} + \delta_i R_{it-j} + \nu_i R_{it} + \omega_i R_{it} + \phi_i \epsilon_{it} + \epsilon_{it}$$

Or written as:

$$R_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} R_{it-j} + \sum_{j=1}^{n} \beta_{ij} R_{it-j} + \delta_i R_{it-j} + \nu_i R_{it} + \omega_i R_{it} + \phi_i \epsilon_{it} + \epsilon_{it}$$

$\beta_{ijkl}$, $\lambda_{ijkl}$, and $\gamma_{ijkl}$ represents the coefficients of the equation.

Table 4.2  
The VECM for Jordan

<table>
<thead>
<tr>
<th></th>
<th>$R_i$ ($i = S$)</th>
<th>$U_i$ ($i = If$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a_i$</td>
<td>0.0127</td>
<td>0.0042</td>
</tr>
<tr>
<td></td>
<td>(0.2672)</td>
<td>(0.2023)</td>
</tr>
<tr>
<td>$b_i$</td>
<td>7.5026**</td>
<td>0.3028***</td>
</tr>
<tr>
<td></td>
<td>(2.6226)</td>
<td>(0.0550)</td>
</tr>
<tr>
<td>$b_{0i}$</td>
<td>-0.298245</td>
<td>-0.0043</td>
</tr>
<tr>
<td></td>
<td>(2.6210)</td>
<td>(0.0545)</td>
</tr>
<tr>
<td>$\delta_i$</td>
<td>0.0921**</td>
<td>0.0007</td>
</tr>
<tr>
<td></td>
<td>(0.0295)</td>
<td>(0.0287)</td>
</tr>
<tr>
<td>$\gamma_i$</td>
<td>0.0075**</td>
<td>-0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0038)</td>
<td>(0.0036)</td>
</tr>
<tr>
<td>$\omega_i$</td>
<td>0.2750***</td>
<td>-0.0001</td>
</tr>
<tr>
<td></td>
<td>(0.0527)</td>
<td>(0.0521)</td>
</tr>
<tr>
<td>$\phi_i$</td>
<td>-0.0285*</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td>(0.0167)</td>
<td>(0.0128)</td>
</tr>
<tr>
<td>$\psi_i$</td>
<td>1.0952</td>
<td>1.0952</td>
</tr>
<tr>
<td></td>
<td>(1.7418)</td>
<td>(1.7418)</td>
</tr>
</tbody>
</table>

$R_i$ and $U_i$ indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in the parentheses (.). Where $S$ is the stock return equation, and $If$ is the unexpected inflation equation. $P$ represents the Jordan stock market index, and CPI represents Jordan Consumer Price Index. The equation is specified as:

$$R_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} R_{it-j} + \sum_{j=1}^{n} \beta_{ij} R_{it-j} + \delta_i R_{it-j} + \nu_i R_{it} + \omega_i R_{it} + \phi_i \epsilon_{it} + \epsilon_{it}$$

Or written as:

$$R_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} R_{it-j} + \sum_{j=1}^{n} \beta_{ij} R_{it-j} + \delta_i R_{it-j} + \nu_i R_{it} + \omega_i R_{it} + \phi_i \epsilon_{it} + \epsilon_{it}$$

$\beta_{ijkl}$, $\lambda_{ijkl}$, and $\gamma_{ijkl}$ represents the coefficients of the equation.

$\beta_{ijkl}$, $\alpha_{ijkl}$, and $\gamma_{ijkl}$ are the coefficients of the equation.

*** Significance at 1%
** Significance at 5%
* Significance at 10%
5.3 Conditional Mean Results

As shown from tables 4.5 – 4.9, there is a dynamic interaction between unexpected inflation and stock returns captured by $\beta_{s_{ij}}$ and $\beta_{i_{fs}}$. The results suggest that the dynamic linkages between these two variables exist only in Jordan, Kuwait, Morocco, Qatar, UAE, and Saudi Arabia. As aforementioned in the previous section, Jordan and Egypt are the only two countries with a long-run relationship. As for, Kuwait, Morocco, Qatar, UAE, and Saudi Arabia, a short-run relationship between unexpected inflation and stock returns exists.

In Kuwait, $\beta_{i_{fi}}$ is significant and negative in the stock returns equation, which shows that unexpected inflation affects stock returns negatively in Kuwait, which is consistent with the literature. The results show that investors in Kuwait are less incentivized to invest in the stock market when there is uncertainty and unanticipated changes in the economy.

In Morocco, $\beta_{i_{fi}}$ is positive and significant in both the stock returns and unexpected inflation equations, which is contradictory to the literature. According to the literature stock returns in Morocco provide a long-run hedge against inflation (Al-Zoubi and Al-Sharkas, 2011). However, the literature states that in the short-run, there is a negative relation between the two variables (Al Khazali, 2003). The reason for the aforementioned results in Morocco is that inflation is relatively low compared to other countries in the MENA region, such as Egypt. That is why the unexpected changes in inflation do not affect investors negatively.

In Qatar, $\beta_{s_{i}}$ is significant and negative in the unexpected inflation, which shows that stock returns have a negative impact on unexpected inflation. This reflects the efforts done by Qatar’s financial sector, which is pushing for an economic transformation. According to Qatar Stock Exchange (QSE) officials, there are plans to introduce more products to attract foreign investment. Qatar has been ranked the 18th in the Global Competitiveness Report 2016-17 and stands as the second in the MENA region. The financial sector’s strength in Qatar has lead to a negative effect on unindicated inflation, as shown in the results.

In UAE (Abu Dhabi and Dubai), $\beta_{i_{fi}}$ is positive and significant in both equations, which is similar to the Morocco results in its contradiction with the literature. Similar to Morocco, the sudden or anticipated inflation in UAE do not cause investors to be discouraged to invest in the stock market. The reason is that expected and unexpected inflation changes are not sufficient to cause such changes.
In Saudi Arabia, $\beta_{1f_i}$ is significant and negative in the short-run, which is similar to the results of previous studies (Tamimi and Abdel Rahman, 2011). Saudi Arabia is one of the most Gulf’s biggest stock markets. However, it has remained one of the most closed stock markets in the world, until June 2015 when the authorities decided to allow limited foreign direct investment. The decision to open up the stock market came after the global decline in oil prices. Hence, investors in the stock market are sensitive to unanticipated changes in the economy, such as unanticipated inflation.
### Table 4.3
Estimated conditional mean equation for Kuwait

<table>
<thead>
<tr>
<th></th>
<th>(R_s (i = S))</th>
<th>(U_{If} (i = If))</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a_i)</td>
<td>-0.1467</td>
<td>0.0049</td>
</tr>
<tr>
<td></td>
<td>(0.0919)</td>
<td>(0.0005)</td>
</tr>
<tr>
<td>(\beta_{si})</td>
<td>-8.7316</td>
<td>0.1509</td>
</tr>
<tr>
<td></td>
<td>(13.6495)</td>
<td>(0.0920)</td>
</tr>
<tr>
<td>(\beta_{Ifi})</td>
<td>-0.4939***</td>
<td>0.0005</td>
</tr>
<tr>
<td></td>
<td>(0.0809)</td>
<td>(0.0005)</td>
</tr>
<tr>
<td>(\delta_i)</td>
<td>0.5620</td>
<td>-0.0029</td>
</tr>
<tr>
<td></td>
<td>(0.4138)</td>
<td>(0.0024)</td>
</tr>
<tr>
<td>(\nu_i)</td>
<td>-0.0028</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0231)</td>
<td>(0.0001)</td>
</tr>
<tr>
<td>(\omega_i)</td>
<td>-0.1335</td>
<td>0.0077*</td>
</tr>
<tr>
<td></td>
<td>(0.7772)</td>
<td>(0.0046)</td>
</tr>
</tbody>
</table>

\(R_s\) and \(U_{If}\) indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in the parentheses (.). where \(i = S\) (for stock return equation) , \(= If\) (for unexpected inflation equation). The equation is specified as:

\[
R_{st} = a_i + \sum_{j=1}^{n} \beta_{yj} U_{If_{t-j}} + \sum_{j=1}^{n} \beta_{xj} R_{st_{t-j}} + \delta_i R_{oil,t} + \nu_i R_{dr,t} + \omega_i R_{dj,t} + \epsilon_{st}
\]

\[
U_{If} = a_i + \sum_{j=1}^{n} \beta_{yj} U_{If_{t-j}} + \sum_{j=1}^{n} \beta_{xj} R_{st_{t-j}} + \delta_i R_{oil,t} + \nu_i R_{dr,t} + \omega_i R_{dj,t} + \epsilon_{If}
\]

\(R_{oil,t}\), \(R_{dr,t}\), and \(R_{dj,t}\) indicates return of Ice Brent Crude (oil), discount rate, and returns of Dow Jones Global Index, respectively.

*** Significance at 1%
**  Significance at 5%
*   Significance at 10%

### Table 4.4
Estimated conditional mean equation for Morocco

<table>
<thead>
<tr>
<th></th>
<th>(R_s (i = S))</th>
<th>(U_{If} (i = If))</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a_i)</td>
<td>0.0280</td>
<td>0.0003</td>
</tr>
<tr>
<td></td>
<td>(0.0357)</td>
<td>(0.0012)</td>
</tr>
<tr>
<td>(\beta_{si})</td>
<td>-3.6959</td>
<td>-0.0152</td>
</tr>
<tr>
<td></td>
<td>(2.5541)</td>
<td>(0.1024)</td>
</tr>
<tr>
<td>(\beta_{Ifi})</td>
<td>0.3182***</td>
<td>0.0083**</td>
</tr>
<tr>
<td></td>
<td>(0.0896)</td>
<td>(0.0035)</td>
</tr>
<tr>
<td>(\delta_i)</td>
<td>0.0501</td>
<td>-0.0024</td>
</tr>
<tr>
<td></td>
<td>(0.0456)</td>
<td>(0.0016)</td>
</tr>
<tr>
<td>(\nu_i)</td>
<td>-0.0078</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td>(0.0117)</td>
<td>(0.0004)</td>
</tr>
<tr>
<td>(\omega_i)</td>
<td>0.0646</td>
<td>0.0015</td>
</tr>
<tr>
<td></td>
<td>(0.0814)</td>
<td>(0.0028)</td>
</tr>
</tbody>
</table>

\(R_s\) and \(U_{If}\) indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in the parentheses (.). where \(i = S\) (for stock return equation) , \(= If\) (for unexpected inflation equation). The equation is specified as:

\[
R_{st} = a_i + \sum_{j=1}^{n} \beta_{yj} U_{If_{t-j}} + \sum_{j=1}^{n} \beta_{xj} R_{st_{t-j}} + \delta_i R_{oil,t} + \nu_i R_{dr,t} + \omega_i R_{dj,t} + \epsilon_{st}
\]

\[
U_{If} = a_i + \sum_{j=1}^{n} \beta_{yj} U_{If_{t-j}} + \sum_{j=1}^{n} \beta_{xj} R_{st_{t-j}} + \delta_i R_{oil,t} + \nu_i R_{dr,t} + \omega_i R_{dj,t} + \epsilon_{If}
\]

\(R_{oil,t}\), \(R_{dr,t}\), and \(R_{dj,t}\) indicates return of Ice Brent Crude (oil), discount rate, and returns of Dow Jones Global Index, respectively.

*** Significance at 1%
**  Significance at 5%
*   Significance at 10%
Table 4.5
Estimated conditional mean equation for Qatar

<table>
<thead>
<tr>
<th></th>
<th>Rs (i = S)</th>
<th>Uf (i = If)</th>
</tr>
</thead>
<tbody>
<tr>
<td>α₀</td>
<td>0.0086</td>
<td>0.0024</td>
</tr>
<tr>
<td></td>
<td>(0.0557)</td>
<td>(0.0021)</td>
</tr>
<tr>
<td>B₀</td>
<td>-3.6734</td>
<td>-0.2148**</td>
</tr>
<tr>
<td></td>
<td>(2.6901)</td>
<td>(0.0988)</td>
</tr>
<tr>
<td>B₁</td>
<td>0.1391</td>
<td>0.0005</td>
</tr>
<tr>
<td></td>
<td>(0.1014)</td>
<td>(0.0037)</td>
</tr>
<tr>
<td>δ₀</td>
<td>0.1142*</td>
<td>0.0035</td>
</tr>
<tr>
<td></td>
<td>(0.0670)</td>
<td>(0.0025)</td>
</tr>
<tr>
<td>γ₀</td>
<td>0.0000</td>
<td>-0.0002</td>
</tr>
<tr>
<td></td>
<td>(0.0115)</td>
<td>(0.0004)</td>
</tr>
<tr>
<td>ω₀</td>
<td>0.3034**</td>
<td>-0.0074</td>
</tr>
<tr>
<td></td>
<td>(0.1332)</td>
<td>(0.0050)</td>
</tr>
</tbody>
</table>

Rs and Uf indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in the parentheses (). where i = S (for stock return equation) , =If (for unexpected inflation equation). The equation is specified as:

\[
R_{st} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} R_{st-j} + \delta_{i} R_{oil,t} + \sigma_i R_{dr,t} + \epsilon_{st}
\]

\[
U_{ft} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} U_{ft-j} + \delta_{i} R_{oil,t} + \sigma_i R_{dr,t} + \epsilon_{ft}
\]

R_{oil,t}, R_{dr,t}, and R_{dj,t} indicates return of Ice Brent Crude (oil), discount rate, and returns of Dow Jones Global Index, respectively.

*** Significance at 1%
** Significance at 5%
* Significance at 10%

---

Table 4.6
Estimated conditional mean equation for UAE – Abu Dhabi

<table>
<thead>
<tr>
<th></th>
<th>Rs (i = S)</th>
<th>Uf (i = If)</th>
</tr>
</thead>
<tbody>
<tr>
<td>α₀</td>
<td>0.0814***</td>
<td>0.0012***</td>
</tr>
<tr>
<td></td>
<td>(0.0324)</td>
<td>(0.0002)</td>
</tr>
<tr>
<td>B₀</td>
<td>3.7822</td>
<td>0.0631</td>
</tr>
<tr>
<td></td>
<td>(4.1405)</td>
<td>(0.0972)</td>
</tr>
<tr>
<td>B₁</td>
<td>0.8399***</td>
<td>0.0026**</td>
</tr>
<tr>
<td></td>
<td>(0.0372)</td>
<td>(0.0008)</td>
</tr>
<tr>
<td>δ₀</td>
<td>0.1159*</td>
<td>0.0004</td>
</tr>
<tr>
<td></td>
<td>(0.0622)</td>
<td>(0.0005)</td>
</tr>
<tr>
<td>γ₀</td>
<td>-0.0808***</td>
<td>-0.0010***</td>
</tr>
<tr>
<td></td>
<td>(0.0330)</td>
<td>(0.0002)</td>
</tr>
<tr>
<td>ω₀</td>
<td>0.2766***</td>
<td>0.0023**</td>
</tr>
<tr>
<td></td>
<td>(0.1144)</td>
<td>(0.0010)</td>
</tr>
</tbody>
</table>

Rs and Uf indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in the parentheses (). where i = S (for stock return equation) , =If (for unexpected inflation equation). The equation is specified as:

\[
R_{st} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} R_{st-j} + \delta_{i} R_{oil,t} + \sigma_i R_{dr,t} + \epsilon_{st}
\]

\[
U_{ft} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} U_{ft-j} + \delta_{i} R_{oil,t} + \sigma_i R_{dr,t} + \epsilon_{ft}
\]

R_{oil,t}, R_{dr,t}, and R_{dj,t} indicates return of Ice Brent Crude (oil), discount rate, and returns of Dow Jones Global Index, respectively.

*** Significance at 1%
** Significance at 5%
* Significance at 10%
Table 4.7
Estimated conditional mean equation for UAE - Dubai

<table>
<thead>
<tr>
<th></th>
<th>( R_s (i = S) )</th>
<th>( U_if (i = If) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha_i )</td>
<td>0.1009*</td>
<td>0.0012***</td>
</tr>
<tr>
<td></td>
<td>(0.0543)</td>
<td>(0.0002)</td>
</tr>
<tr>
<td>( B_{si} )</td>
<td>8.3517</td>
<td>0.0760</td>
</tr>
<tr>
<td></td>
<td>(7.0173)</td>
<td>(0.0942)</td>
</tr>
<tr>
<td>( B_{si} )</td>
<td>0.8387***</td>
<td>0.0013*</td>
</tr>
<tr>
<td></td>
<td>(0.0382)</td>
<td>(0.0005)</td>
</tr>
<tr>
<td>( \delta_i )</td>
<td>0.2904*</td>
<td>0.0003</td>
</tr>
<tr>
<td></td>
<td>(0.1066)</td>
<td>(0.0005)</td>
</tr>
<tr>
<td>( \nu_i )</td>
<td>-0.1071**</td>
<td>-0.0010***</td>
</tr>
<tr>
<td></td>
<td>(0.0554)</td>
<td>(0.0003)</td>
</tr>
<tr>
<td>( \omega_i )</td>
<td>0.5416**</td>
<td>0.0028*</td>
</tr>
<tr>
<td></td>
<td>(0.1902)</td>
<td>(0.0010)</td>
</tr>
</tbody>
</table>

\( R_s \) and \( U_if \) indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in the parentheses (.). \( i = S \) (for stock return equation), \( i = If \) (for unexpected inflation equation). The equation is specified as:

\[
R_{st} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} U_{if_{j-1}} + \sum_{j=1}^{n} \beta_{isj} R_{st-j} + \delta_i R_{oil,t} + \nu_i R_{dr,t} + \epsilon_{st}
\]

\[
U_{if_t} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} U_{if_{j-1}} + \sum_{j=1}^{n} \beta_{isj} R_{st-j} + \delta_i R_{oil,t} + \nu_i R_{dr,t} + \omega_i + \epsilon_{if_t}
\]

\( R_{oil,t} \), \( R_{dr,t} \), and \( R_{dj,t} \) indicates return of Ice Brent Crude (oil), discount rate, and returns of Dow Jones Global Index, respectively.

*** Significance at 1%
** Significance at 5%
* Significance at 10%

---

Table 4.8
Estimated conditional mean equation for Tunisia

<table>
<thead>
<tr>
<th></th>
<th>( R_s (i = S) )</th>
<th>( U_if (i = If) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha_i )</td>
<td>29.8290</td>
<td>0.0039***</td>
</tr>
<tr>
<td></td>
<td>(29.9065)</td>
<td>(0.0004)</td>
</tr>
<tr>
<td>( B_{si} )</td>
<td>-8248.7350</td>
<td>-0.0896</td>
</tr>
<tr>
<td></td>
<td>(8261.7600)</td>
<td>(0.1393)</td>
</tr>
<tr>
<td>( B_{si} )</td>
<td>-0.090</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.1351)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>( \delta_i )</td>
<td>0.045</td>
<td>0.0000*</td>
</tr>
<tr>
<td></td>
<td>(0.0515)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>( \nu_i )</td>
<td>0.007</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0117)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>( \omega_i )</td>
<td>-0.0813</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.1405)</td>
<td>(0.0000)</td>
</tr>
</tbody>
</table>

\( R_s \) and \( U_if \) indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in the parentheses (.). \( i = S \) (for stock return equation), \( i = If \) (for unexpected inflation equation). The equation is specified as:

\[
R_{st} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} U_{if_{j-1}} + \sum_{j=1}^{n} \beta_{isj} R_{st-j} + \delta_i R_{oil,t} + \nu_i R_{dr,t} + \omega_i R_{dj,t} + \epsilon_{st}
\]

\[
U_{if_t} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} U_{if_{j-1}} + \sum_{j=1}^{n} \beta_{isj} R_{st-j} + \delta_i R_{oil,t} + \nu_i R_{dr,t} + \omega_i + \epsilon_{if_t}
\]

\( R_{oil,t} \), \( R_{dr,t} \), and \( R_{dj,t} \) indicates return of Ice Brent Crude (oil), discount rate, and returns of Dow Jones Global Index, respectively.

*** Significance at 1%
** Significance at 5%
* Significance at 10%
### Table 4.9
Estimated conditional mean equation for Saudi Arabia

<table>
<thead>
<tr>
<th></th>
<th>$R_s (i = S)$</th>
<th>$U_i (i = If)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a_i$</td>
<td>-0.0144</td>
<td>0.0050***</td>
</tr>
<tr>
<td></td>
<td>(0.0152)</td>
<td>(0.0002)</td>
</tr>
<tr>
<td>$B_{si}$</td>
<td>3.7295</td>
<td>-0.0766</td>
</tr>
<tr>
<td></td>
<td>(4.2018)</td>
<td>(0.0811)</td>
</tr>
<tr>
<td>$B_{si}$</td>
<td>-0.5644***</td>
<td>0.0006</td>
</tr>
<tr>
<td></td>
<td>(0.0751)</td>
<td>(0.0014)</td>
</tr>
<tr>
<td>$\delta_i$</td>
<td>0.2260**</td>
<td>-0.0007</td>
</tr>
<tr>
<td></td>
<td>(0.0754)</td>
<td>(0.0013)</td>
</tr>
<tr>
<td>$\nu_i$</td>
<td>0.0019</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0040)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>$\omega_i$</td>
<td>0.5975***</td>
<td>0.0012</td>
</tr>
<tr>
<td></td>
<td>(0.1319)</td>
<td>(0.0023)</td>
</tr>
</tbody>
</table>

$R_s$ and $U_i$ indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in the parentheses (.). where $i = S$ (for stock return equation), $i = If$ (for unexpected inflation equation). The equation is specified as:

$$R_s = a_i + \sum_{j=1}^{n} \beta_{ij} U_{i-f-1} + \sum_{j=1}^{n} \beta_{ij} R_{s-1-j} + \delta_i R_{oil,t} + \nu_i R_{dr,t} + \epsilon_{st}$$

$$U_{If} = a_i + \sum_{j=1}^{n} \beta_{ij} U_{If-f-1} + \sum_{j=1}^{n} \beta_{ij} R_{s-1-j} + \delta_i R_{oil,t} + \nu_i R_{dr,t} + \epsilon_{If}$$

$R_{oil,t}$, $R_{dr,t}$, and $R_{dj,t}$ indicate return of Ice Brent Crude (oil), discount rate, and returns of Dow Jones Global Index, respectively.

*** Significance at 1%
** Significance at 5%
* Significance at 10%
We also examine the impact of the control variables on stock returns and unexpected inflation. We found that the return on the Dow Jones Global Index (captured by $\delta$) has a positive impact on stock returns in Egypt, Jordan, Qatar, UAE, and Saudi Arabia. On the other hand, our results show that the return on the Dow Jones Global Index has a positive impact on unexpected inflation in Kuwait and UAE.

The impact of the discount rate on stock market returns and unexpected inflation is captured by the coefficient $\nu$. The literature states that since the discount rate changes contain “announcements effects” about the course of future monetary policy, they affect security prices. The empirical evidence for this theory is provided by Baker and Meyer (1980), and Brown (1981), who revealed in their studies a significant announcement effects of discount rate changes on a variety of securities. Another study by Yawtiz and Smirlock (1985) shows that discount rate changes only have an impact when changes are non-technical, or contain news about future monetary policy. If the discount rate changes are non-technical, they had a negative impact on stock returns. The results also show that the market adjustment occurs by the end of the announcement day, confirming the efficient market hypothesis theory. As for the technical changes, which carry no news or announcements, there was no stock market reaction. According to our results, the discount rate has a positive impact on stock returns in Egypt and Jordan. For the UAE, the impact is negative on the stock returns in Dubai and negative on both stock returns and unexpected inflation in Abu Dhabi. Going by the aforementioned theory, the only non-technical discount rate changes occurred in Egypt, Jordan, and UAE. In Egypt and Jordan, when there is a higher discount rate, stock returns increase. As for the UAE, our results are consistent with Yawtiz and Smirlock (1985), with stock returns declining with an increase in discount rates. As for the unexpected inflation equation, there is a significant and negative effect only in Abu Dhabi.

Finally we examine the impact of oil prices (captured by $\delta$) on stock returns and unexpected inflation. There are four countries out of the 8 countries in our sample which are members of the Organization of the Petroleum Exporting Countries (OPEC) and Gulf Cooperation Council (GCC); Kuwait, Qatar, UAE, and Saudi Arabia. The GCC countries depend heavily on oil exports which strongly affect their governments’ budget revenues and expenditures. Therefore, the price of oil could be considered one of the primary determinants of aggregate demand, which consequently affects corporate output and domestic prices. Following
the aforementioned theory, oil prices would eventually impact corporate earnings and share prices. Previous studies have shown that the impact of oil prices on stock returns varies. In some studies, there was a positive impact, while in others there was a negative or no impact. (see for example Mohanty et al. 2011, Arouiri et al. 2011, Fayyad and Daly 2011, Hammoudeh and Aleisa 2004).

As aforementioned, the results of previous studies vary according to the country being examined. In our results, all the GCC countries, except Kuwait, showed a positive and significant relationship between oil prices and stock returns. For Kuwait, there is no significant relationship between stock returns and oil prices, which is consistent with the results of Mohanty et al. 2011’s study. This suggests that “stock markets in emerging countries operate under a different set of market forces, competitive environments, and government regulations” (Mohanty et al. 2011). The reason for Kuwait being the exception is that the economy has a huge buffer to absorb the falling oil prices in the past years. For example, government and private sector consumption represented 41% of GDP in 2013, while net exports and fixed capital formation accounted for the remaining 45% and 15%, respectively. Therefore, the savings in the Kuwaiti economy allow the stock returns to remain unaffected by changes in oil prices, as shown in the results. Moreover, our results indicate that there is a positive and significant relationship in Jordan. The reason behind the positive and significant effect of oil prices on stock returns in Morocco is that authorities have ended the gasoline and fuel oil subsidies in 2014. Currently, Morocco is leading the MENA region on public subsidy reform. That is why, unlike Egypt which still did not end fuel subsidies, Morocco’s stock market experience a positive and significant impact from oil prices.

With regards to the unexpected inflation equation, our results show that there is no significant relationship between unexpected inflation and oil prices in any country except Tunisia, where there is a positive and significant relationship. According to the literature, oil price changes have an impact on inflation on the long-run in Tunisia (Brini et. Al, 2016). Tunisia is an oil-importing country and it is expected that a change in the oil price will cause an increase in the overall prices. In Tunisia, oil is one of the main sources of manufacturing and distribution of goods and services. Therefore, an increase in oil prices will cause an increase in manufacturing and distribution prices, which will eventually cause inflation (Brini et. Al, 2016).
5.4 Volatility Results

In this subsection, we present the results of the estimated joint volatility dynamics between stock returns and unanticipated inflation in each of the eight MENA countries. The estimates of the conditional variance equations in the VECH-GARCH are presented in table 5.1-5.9 for Egypt, Jordan, Kuwait, Morocco, Qatar, UAE, Tunisia, Saudi Arabia, respectively. The coefficient \( a_{ss} \) captures news effect on the variance of stock return, while \( a_{diff} \) captures the news effect on the dynamic covariance. While \( b_{ss} \), \( b_{diff} \) captures memory effect of the shock to the variance of stock returns, and to the variance of the unexpected inflation respectively.

Our results show a significant news effect on stock returns for Jordan, Kuwait, Qatar, Dubai, and Saudi Arabia. The results also reveal that all the aforementioned countries are impacted by the news effect which has a positive impact on stock returns. This means that news or announcements in the market have a positive impact on the stock returns in Jordan, Kuwait, Qatar, Dubai, and Saudi Arabia. As for the news effect on unexpected inflation, it is significant and negative in Egypt, and significant and positive in Qatar and Saudi Arabia. Therefore, news in Egypt affects unexpected inflation negatively, while in Qatar and Saudi Arabia, it has a positive impact on unexpected inflation. According to the literature, the stock markets in the MENA region “do not feel the high up and down movements in the markets” (Al-Rjoub, 2005). In other words, Al Rjoub’s study shows that the asymmetric news effect is absent in the MENA region.

The memory effect of the volatility in stock returns is significant for all countries except Tunisia and Egypt. With regards to the memory effect of the volatility in unexpected inflation, the results show a memory effect that is significant in all countries except Jordan and Abu Dhabi. The results also suggest that a high persistence in volatility exists in all countries except on stock returns in Egypt, and on unexpected inflation in UAE (Abu Dhabi) and Saudi Arabia. This suggests that the future volatility for all countries which have a high persistence level, is likely to be influenced by today’s volatility. Therefore, traders could gain valuable information which is embedded in the past stock returns and unexpected inflation volatility series for future predictions. Previous studies show evidence of long run memory in the returns of equity markets in Egypt and Morocco, while not a strong evidence in the equity markets of Jordan (Assaf, 2006). Other studies have shown that evidence of long run memory in the stock return volatility
Egypt, Jordan, Kuwait, and Morocco (Jayasuriya, 2009). The results of various previous studies differ mostly due to the choice of volatility measure.
**Table 5.1**
The estimated bivariate UEDCC-GARCH model for Egypt

<table>
<thead>
<tr>
<th></th>
<th>( R_t )</th>
<th>( U_{it} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Pi_{it} )</td>
<td>0.0038</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0034)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>( \alpha_i )</td>
<td>0.1465</td>
<td>-0.0655*</td>
</tr>
<tr>
<td></td>
<td>(0.1751)</td>
<td>(0.0253)</td>
</tr>
<tr>
<td>( B_i )</td>
<td>0.3115</td>
<td>1.027***</td>
</tr>
<tr>
<td></td>
<td>(0.5803)</td>
<td>(0.0318)</td>
</tr>
</tbody>
</table>

\( R_i \) and \( U_{it} \) indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in (.), where \( i = S \) (for stock returns). If (for unexpected inflation changes). We use VECH-GARCH to model the volatility behavior.

\[
\begin{align*}
\begin{bmatrix}
    h_{SS} \\
    h_{SFX} \\
    b_{FSX}
\end{bmatrix}
&= \begin{bmatrix}
    \Omega \\
    \Lambda \\
    \alpha
\end{bmatrix}
+ \begin{bmatrix}
    a_{SS}  & 0 & 0 \\
    0 & a_{SFX} & 0 \\
    0 & 0 & a_{FSX}
\end{bmatrix}
\begin{bmatrix}
    \varepsilon_{i,S,t-1}^2 \\
    \varepsilon_{i,F,t-1}^2 \\
    \varepsilon_{i,S,F,t-1}^2
\end{bmatrix}
\end{align*}
\]

*** Significance at 1%  
** Significance at 5%  
* Significance at 10%

**Table 5.2**
The estimated bivariate UEDCC-GARCH model for Jordan

<table>
<thead>
<tr>
<th></th>
<th>( R_t )</th>
<th>( U_{it} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Pi_{it} )</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>( \alpha_i )</td>
<td>0.2503***</td>
<td>-0.0292</td>
</tr>
<tr>
<td></td>
<td>(0.0738)</td>
<td>(0.0425)</td>
</tr>
<tr>
<td>( B_i )</td>
<td>0.7553***</td>
<td>0.6056</td>
</tr>
<tr>
<td></td>
<td>(0.0647)</td>
<td>(0.5765)</td>
</tr>
</tbody>
</table>

\( R_i \) and \( U_{it} \) indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in (.), where \( i = S \) (for stock returns). If (for unexpected inflation changes). We use VECH-GARCH to model the volatility behavior.

\[
\begin{align*}
\begin{bmatrix}
    h_{SS} \\
    h_{SFX} \\
    b_{FSX}
\end{bmatrix}
&= \begin{bmatrix}
    \Omega \\
    \Lambda \\
    \alpha
\end{bmatrix}
+ \begin{bmatrix}
    a_{SS}  & 0 & 0 \\
    0 & a_{SFX} & 0 \\
    0 & 0 & a_{FSX}
\end{bmatrix}
\begin{bmatrix}
    \varepsilon_{i,S,t-1}^2 \\
    \varepsilon_{i,F,t-1}^2 \\
    \varepsilon_{i,S,F,t-1}^2
\end{bmatrix}
\end{align*}
\]

*** Significance at 1%  
** Significance at 5%  
* Significance at 10%

**Table 5.3**
The estimated bivariate UEDCC-GARCH model for Kuwait

<table>
<thead>
<tr>
<th></th>
<th>( R_t )</th>
<th>( U_{it} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Pi_{it} )</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>( \alpha_i )</td>
<td>0.1825**</td>
<td>0.0903</td>
</tr>
<tr>
<td></td>
<td>(0.0650)</td>
<td>(0.0606)</td>
</tr>
<tr>
<td>( B_i )</td>
<td>0.9260***</td>
<td>0.8646***</td>
</tr>
<tr>
<td></td>
<td>(0.0485)</td>
<td>(0.0998)</td>
</tr>
</tbody>
</table>

\( R_i \) and \( U_{it} \) indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in (.), where \( i = S \) (for stock returns). If (for unexpected inflation changes). We use VECH-GARCH to model the volatility behavior.

\[
\begin{align*}
\begin{bmatrix}
    h_{SS} \\
    h_{SFX} \\
    b_{FSX}
\end{bmatrix}
&= \begin{bmatrix}
    \Omega \\
    \Lambda \\
    \alpha
\end{bmatrix}
+ \begin{bmatrix}
    a_{SS}  & 0 & 0 \\
    0 & a_{SFX} & 0 \\
    0 & 0 & a_{FSX}
\end{bmatrix}
\begin{bmatrix}
    \varepsilon_{i,S,t-1}^2 \\
    \varepsilon_{i,F,t-1}^2 \\
    \varepsilon_{i,S,F,t-1}^2
\end{bmatrix}
\end{align*}
\]

*** Significance at 1%  
** Significance at 5%  
* Significance at 10%

**Table 5.4**
The estimated bivariate UEDCC-GARCH model for Morocco

<table>
<thead>
<tr>
<th></th>
<th>( R_t )</th>
<th>( U_{it} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Pi_{it} )</td>
<td>0.0001</td>
<td>0.0000**</td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>( \alpha_i )</td>
<td>0.0807</td>
<td>-0.0028</td>
</tr>
<tr>
<td></td>
<td>(0.0580)</td>
<td>(0.0051)</td>
</tr>
<tr>
<td>( B_i )</td>
<td>0.8595***</td>
<td>0.9176***</td>
</tr>
<tr>
<td></td>
<td>(0.0714)</td>
<td>(0.0573)</td>
</tr>
</tbody>
</table>

\( R_i \) and \( U_{it} \) indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in (.), where \( i = S \) (for stock returns). If (for unexpected inflation changes). We use VECH-GARCH to model the volatility behavior.

\[
\begin{align*}
\begin{bmatrix}
    h_{SS} \\
    h_{SFX} \\
    b_{FSX}
\end{bmatrix}
&= \begin{bmatrix}
    \Omega \\
    \Lambda \\
    \alpha
\end{bmatrix}
+ \begin{bmatrix}
    a_{SS}  & 0 & 0 \\
    0 & a_{SFX} & 0 \\
    0 & 0 & a_{FSX}
\end{bmatrix}
\begin{bmatrix}
    \varepsilon_{i,S,t-1}^2 \\
    \varepsilon_{i,F,t-1}^2 \\
    \varepsilon_{i,S,F,t-1}^2
\end{bmatrix}
\end{align*}
\]

*** Significance at 1%  
** Significance at 5%  
* Significance at 10%
Table 5.5
The estimated bivariate UEDCC-GARCH model for Qatar

<table>
<thead>
<tr>
<th>R_i</th>
<th>U_i</th>
</tr>
</thead>
<tbody>
<tr>
<td>Π_i</td>
<td>0.0001*** 0.0000</td>
</tr>
<tr>
<td>(0.0000) (0.0000)</td>
<td></td>
</tr>
<tr>
<td>a_i</td>
<td>-0.0559** 0.4861***</td>
</tr>
<tr>
<td>(0.0264) (0.1447)</td>
<td></td>
</tr>
<tr>
<td>B_i</td>
<td>1.0036*** 0.7263***</td>
</tr>
<tr>
<td>(0.0247) (0.0720)</td>
<td></td>
</tr>
</tbody>
</table>

R_i and U_i indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in (.), where i = S (for stock returns), If (for unexpected inflation changes). We use VEC-GARCH to model the volatility behavior.

\[
\begin{align*}
\begin{bmatrix} h_{ss} \\ h_{sf} \\ h_{fs} \\ h_{ff} \end{bmatrix} & = \begin{bmatrix} \Omega_2 \\ \Omega_3 \\ \Omega_4 \\ \Omega_5 \end{bmatrix} + \begin{bmatrix} a_{ss} & 0 & 0 & 0 \\ 0 & a_{sf} & 0 & 0 \\ 0 & 0 & a_{fsf} & 0 \\ 0 & 0 & 0 & a_{ff} \end{bmatrix} \begin{bmatrix} \epsilon_{ss,t-1}^2 \\ \epsilon_{sf,t-1}^2 \\ \epsilon_{fs,t-1}^2 \\ \epsilon_{ff,t-1}^2 \end{bmatrix} \\
\end{align*}
\]

*** Significance at 1%  ** Significance at 5% * Significance at 10%

Table 5.6
The estimated bivariate UEDCC-GARCH model for UAE- Abu Dhabi

<table>
<thead>
<tr>
<th>R_i</th>
<th>U_i</th>
</tr>
</thead>
<tbody>
<tr>
<td>Π_i</td>
<td>0.0001 0.0000</td>
</tr>
<tr>
<td>(0.0001) (0.0000)</td>
<td></td>
</tr>
<tr>
<td>a_i</td>
<td>0.1558 0.2485</td>
</tr>
<tr>
<td>(0.1130) (0.1832)</td>
<td></td>
</tr>
<tr>
<td>B_i</td>
<td>0.7660*** 0.3451</td>
</tr>
<tr>
<td>(0.1400) (0.3247)</td>
<td></td>
</tr>
</tbody>
</table>

R_i and U_i indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in (.), where i = S (for stock returns), If (for unexpected inflation changes). We use VEC-GARCH to model the volatility behavior.

\[
\begin{align*}
\begin{bmatrix} h_{ss} \\ h_{sf} \\ h_{fs} \\ h_{ff} \end{bmatrix} & = \begin{bmatrix} \Omega_2 \\ \Omega_3 \\ \Omega_4 \\ \Omega_5 \end{bmatrix} + \begin{bmatrix} a_{ss} & 0 & 0 & 0 \\ 0 & a_{sf} & 0 & 0 \\ 0 & 0 & a_{fsf} & 0 \\ 0 & 0 & 0 & a_{ff} \end{bmatrix} \begin{bmatrix} \epsilon_{ss,t-1}^2 \\ \epsilon_{sf,t-1}^2 \\ \epsilon_{fs,t-1}^2 \\ \epsilon_{ff,t-1}^2 \end{bmatrix} \\
\end{align*}
\]

*** Significance at 1%  ** Significance at 5% * Significance at 10%

Table 5.7
The estimated bivariate UEDCC-GARCH model for UAE- Dubai

<table>
<thead>
<tr>
<th>R_i</th>
<th>U_i</th>
</tr>
</thead>
<tbody>
<tr>
<td>Π_i</td>
<td>0.0010 0.0000</td>
</tr>
<tr>
<td>(0.0008) (0.0000)</td>
<td></td>
</tr>
<tr>
<td>a_i</td>
<td>0.20435* 0.0215</td>
</tr>
<tr>
<td>(0.1147) (0.0426)</td>
<td></td>
</tr>
<tr>
<td>B_i</td>
<td>0.5973*** 0.8761***</td>
</tr>
<tr>
<td>(0.2233) (0.1025)</td>
<td></td>
</tr>
</tbody>
</table>

R_i and U_i indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in (.), where i = S (for stock returns), If (for unexpected inflation changes). We use VEC-GARCH to model the volatility behavior.

\[
\begin{align*}
\begin{bmatrix} h_{ss} \\ h_{sf} \\ h_{fs} \\ h_{ff} \end{bmatrix} & = \begin{bmatrix} \Omega_2 \\ \Omega_3 \\ \Omega_4 \\ \Omega_5 \end{bmatrix} + \begin{bmatrix} a_{ss} & 0 & 0 & 0 \\ 0 & a_{sf} & 0 & 0 \\ 0 & 0 & a_{fsf} & 0 \\ 0 & 0 & 0 & a_{ff} \end{bmatrix} \begin{bmatrix} \epsilon_{ss,t-1}^2 \\ \epsilon_{sf,t-1}^2 \\ \epsilon_{fs,t-1}^2 \\ \epsilon_{ff,t-1}^2 \end{bmatrix} \\
\end{align*}
\]

*** Significance at 1%  ** Significance at 5% * Significance at 10%

Table 5.8
The estimated bivariate UEDCC-GARCH model for Tunisia

<table>
<thead>
<tr>
<th>R_i</th>
<th>U_i</th>
</tr>
</thead>
<tbody>
<tr>
<td>Π_i</td>
<td>0.0004 0.0000</td>
</tr>
<tr>
<td>(0.0042) (0.0000)</td>
<td></td>
</tr>
<tr>
<td>a_i</td>
<td>0.0597 0.1545</td>
</tr>
<tr>
<td>(0.0127) (2.5873)</td>
<td></td>
</tr>
<tr>
<td>B_i</td>
<td>0.5590 1.0717***</td>
</tr>
<tr>
<td>(3.8126) (0.0715)</td>
<td></td>
</tr>
</tbody>
</table>

R_i and U_i indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in (.), where i = S (for stock returns), If (for unexpected inflation changes). We use VEC-GARCH to model the volatility behavior.

\[
\begin{align*}
\begin{bmatrix} h_{ss} \\ h_{sf} \\ h_{fs} \\ h_{ff} \end{bmatrix} & = \begin{bmatrix} \Omega_2 \\ \Omega_3 \\ \Omega_4 \\ \Omega_5 \end{bmatrix} + \begin{bmatrix} a_{ss} & 0 & 0 & 0 \\ 0 & a_{sf} & 0 & 0 \\ 0 & 0 & a_{fsf} & 0 \\ 0 & 0 & 0 & a_{ff} \end{bmatrix} \begin{bmatrix} \epsilon_{ss,t-1}^2 \\ \epsilon_{sf,t-1}^2 \\ \epsilon_{fs,t-1}^2 \\ \epsilon_{ff,t-1}^2 \end{bmatrix} \\
\end{align*}
\]

*** Significance at 1%  ** Significance at 5% * Significance at 10%
Table 5.9
The estimated bivariate UEDCC-GARCH model for Saudi Arabia

<table>
<thead>
<tr>
<th></th>
<th>Rs</th>
<th>Ul</th>
</tr>
</thead>
<tbody>
<tr>
<td>Πᵢ</td>
<td>0.0001</td>
<td>0.0000*</td>
</tr>
<tr>
<td></td>
<td>(0.0001)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>αᵢ</td>
<td>0.3166***</td>
<td>0.9732***</td>
</tr>
<tr>
<td></td>
<td>(0.1291)</td>
<td>(0.2352)</td>
</tr>
<tr>
<td>βᵢ</td>
<td>0.6913***</td>
<td>0.2891***</td>
</tr>
<tr>
<td></td>
<td>(0.0941)</td>
<td>(0.0664)</td>
</tr>
</tbody>
</table>

Rs and Ul indicate stock market returns and unexpected inflation changes, respectively. Heteroscedasticity-consistent standard errors are in (), where i = S (for stock returns), If (for unexpected inflation changes). We use VECCH-GARCH to model the volatility behavior:

$$\begin{bmatrix} h_{ss} \\ h_{sfx} \\ h_{fxs} \end{bmatrix} = \begin{bmatrix} \Omega_1 \\ \Omega_2 \\ \Omega_3 \end{bmatrix} + \begin{bmatrix} a_{ss} & 0 & 0 \\ 0 & a_{sfx} & 0 \\ 0 & 0 & a_{fxs} \end{bmatrix} \begin{bmatrix} \varepsilon_{ss,t-1}^2 \\ \varepsilon_{sf,t-1}^2 \\ \varepsilon_{fx,t-1}^2 \end{bmatrix} + \begin{bmatrix} b_{ss} & 0 & 0 \\ 0 & b_{sfx} & 0 \\ 0 & 0 & b_{fxs} \end{bmatrix} \begin{bmatrix} h_{ss,t-1} \\ h_{sfx,t-1} \\ h_{fxs,t-1} \end{bmatrix}$$

*** Significance at 1%
** Significance at 5%
* Significance at 10%
6. Conclusion

The dissertation examines the relation between stock returns and unexpected inflation in eight MENA countries; Egypt, Jordan, Kuwait, Morocco, Qatar, UAE, Tunisia, and Saudi Arabia. Our sample is from January 2005-December 2016.

We found mixed results of the impact of unexpected inflation on stock returns and the impact of the three control variables; namely, the global world index, oil prices and discount rate, on stock returns and unexpected inflation in the examined countries. The results were different across countries. For example, our results show that there is a long-run relationship between stock returns and unexpected inflation in Egypt and Jordan only. Also, the Dow Jones Global index has an influence on stock returns and unexpected inflation in Egypt, Jordan, Qatar, UAE, Kuwait, and Saudi Arabia. The impact of the discount rate on stock returns and unexpected inflation exists in Egypt, Jordan, and UAE. While oil prices have a positive and significant impact on the stock returns of all GCC countries in our study except Kuwait. However, oil prices have no significant impact on unexpected inflation except in Tunisia, where there is a positive and significant impact.

Using Johansen (1995) trace test for co-integration, we found evidence of long run relation between stock returns and unexpected inflation in Egypt and Jordan. The estimation of the bivariate VAR(VECM) VECH-GARCH for Jordan suggests that the adjustment takes place through stock returns and implying causality from unexpected inflation to stock returns in the long-run. The results also show that the adjustment to the long-run equilibrium is slow in Jordan. As for Egypt, the error correction coefficient in both the unexpected inflation and stock returns equation is insignificant.

Modelling the volatility of the unexpected inflation and stock return and their variances using VECH-GARCH, reveals mixed results with the news effect having a significant and positive impact on stock returns in Jordan, Kuwait, Qatar, Dubai, and Saudi Arabia. On the other hand, the memory effect of the volatility in stock returns is significant for all countries except Tunisia and Egypt. With regards to the memory effect of the volatility in unexpected inflation, the results show a memory effect that is significant in all countries except Jordan and Abu Dhabi.

Our results vary significantly depending on the country being examined. The dissertation results show that each country’s economic conditions hugely affect the relationship between unexpected inflation and stock returns. According to our results, stock returns could not provide
a long-run hedge against inflation. Not all our findings are similar to the previous studies in the literature, due to different periods of time of country examination and different measures in modelling. Moreover, as indicated in the results, the fiscal and monetary policies of countries contributed to the different results we had in the eight countries. This point could open further research on the impact of Central Bank regulations on inflation and stock returns in the MENA region.
References


APPENDIX 1

ADF TESTS ON CPIs AND INDICES

EGYPT

CPI

Null Hypothesis: CPI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>3.457319</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.478805
- 5% level: -2.881830
- 10% level: -2.577568


STOCK MARKET INDEX

Null Hypothesis: EGX30 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-1.450240</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.478472
- 5% level: -2.881685
- 10% level: -2.577591


JORDAN

CPI

Null Hypothesis: CPI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-1.712058</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.476055
- 5% level: -2.881830
- 10% level: -2.577568


STOCK MARKET INDEX
Null Hypothesis: JOR30 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>Test</th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dickey-Fuller test</td>
<td>-1.622146</td>
<td>0.4687</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.476472</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.951685</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.577591</td>
<td></td>
</tr>
</tbody>
</table>


**KUWAIT**

**CPI**

Null Hypothesis: CPI has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>Test</th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dickey-Fuller test</td>
<td>-0.619361</td>
<td>0.8615</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.477487</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.992127</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.577227</td>
<td></td>
</tr>
</tbody>
</table>


**STOCK MARKET INDEX**

Null Hypothesis: K15 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>Test</th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dickey-Fuller test</td>
<td>-3.445740</td>
<td>0.0110</td>
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<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.476547</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.982390</td>
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</tr>
<tr>
<td>10% level</td>
<td>-2.576074</td>
<td></td>
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</table>


**MOROCCO**

**CPI**

Null Hypothesis: CPI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>Test</th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dickey-Fuller test</td>
<td>-0.903597</td>
<td>0.7846</td>
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<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.476472</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.951685</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.577591</td>
<td></td>
</tr>
</tbody>
</table>

STOCK MARKET INDEX

Null Hypothesis: CASIND has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>T-Statistic</th>
<th>Prob. *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-2.361107</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.470472
- 5% level: -2.861885
- 10% level: -2.577091


QATAR

CPI

Null Hypothesis: CPI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>T-Statistic</th>
<th>Prob. *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>0.436884</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.476985
- 5% level: -2.861885
- 10% level: -2.577091


STOCK MARKET INDEX

Null Hypothesis: QEIND has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>T-Statistic</th>
<th>Prob. *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-2.263366</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.476985
- 5% level: -2.861885
- 10% level: -2.577091


UAE

CPI

Null Hypothesis: CPI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

<table>
<thead>
<tr>
<th>T-Statistic</th>
<th>Prob. *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-0.240968</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.437747
- 5% level: -2.865200
- 10% level: -2.581596

STOCK MARKET INDEX

DUBAI

Null Hypothesis: DUBAINX has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-2.356847</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.487144
- 5% level: -2.881978
- 10% level: -2.577747


ABU DHABI

Null Hypothesis: ABUDHIN has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-2.414143</td>
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</tbody>
</table>

Test critical values:
- 1% level: -3.487144
- 5% level: -2.881978
- 10% level: -2.577747

TUNISIA

CPI

Null Hypothesis: CPI has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>3.075029</td>
</tr>
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</table>

Test critical values:
- 1% level: -3.487335
- 5% level: -2.882279
- 10% level: -2.577308


STOCK MARKET

Null Hypothesis: TND has a unit root
Exogenous: Constant
Lag Length: 6 (Automatic - based on SIC, maxlag=10)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-0.811890</td>
</tr>
</tbody>
</table>

Test critical values:
- 1% level: -3.546208
- 5% level: -2.912031
- 10% level: -2.594027

SAUDI ARABIA

CPI

Null Hypothesis: CPI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>Test statistic</th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-0.864898</td>
<td>0.7446</td>
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</tbody>
</table>

Test critical values:

<table>
<thead>
<tr>
<th>Level</th>
<th>1% level</th>
<th>5% level</th>
<th>10% level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-3.470072</td>
<td>-2.601998</td>
<td>-2.577591</td>
</tr>
</tbody>
</table>


STOCK MARKET

Null Hypothesis: LTEDIX has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

<table>
<thead>
<tr>
<th>Test statistic</th>
<th>t-Statistic</th>
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<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-1.064421</td>
<td>0.4376</td>
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</table>

Test critical values:

<table>
<thead>
<tr>
<th>Level</th>
<th>1% level</th>
<th>5% level</th>
<th>10% level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-3.476472</td>
<td>-2.881686</td>
<td>-2.577591</td>
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</tbody>
</table>