

Gulf Cooperation Council Countries' Stock Market Response to US Federal Reserve Policy Actions

A Thesis

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by

Muathe Hammad Al Rowaily

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ABSTRACT

This study examines the effects of changes in the United States' (US) monetary policy actions on the Gulf Cooperation Council (GCC) countries' stock markets. Efficient financial markets are unlikely to respond to anticipated policy actions. Therefore, Federal funds futures data are used to categorize the changes in monetary policy actions into anticipated and unanticipated components. The results indicate that equity returns across the GCC are roughly 19 percentage points more volatile on monetary policy event days than non-event days. We find that a surprise change in the Federal funds rate is positive on equity prices and statistically significant across all GCC countries except for Bahrain, where it is negative and statistically significant. On average, a hypothetical unanticipated 25-basis-point hike in the Federal funds rate target is associated with a 1.5% increase in the GCC broad stock indexes. These findings are relevant to both the direction and context of Federal funds rate surprises.

BIOLOGICAL SKETCH

Muathe Hammad Al Rowaily is a graduate student in the Applied Economics and Management program at the Charles H. Dyson School at Cornell University. His research is focused on the effects of monetary policy on global financial markets.

Muathe is originally from Saudi Arabia. As the son of a former diplomat, he had the opportunity to experience many different cultures and interact with people from different parts of the world. He has lived in Saudi Arabia, Spain, Morocco, Hong Kong, Mexico, and the United States of America. In 2015, Muathe received his high school diploma from the Delia School of Canada, Hong Kong. In 2019, Muathe earned his Bachelor of Science degree with a major in finance and a minor in economics from Virginia Commonwealth University, USA. As an undergraduate, he earned the distinctions of summa cum laude, university honors, and business honors. Muathe received a fully funded scholarship from the Central Bank of the Kingdom of Saudi Arabia to pursue his graduate studies.

This thesis is dedicated to my mother for her love, endless support, and encouragement.

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LIST OF ABBREVIATIONS

BB	Bahrain Bourse
BK	Boursa Kuwait
CBOT	Chicago Board of Trade
DFM	Dubai Financial Market
DSM	Doha Securities Market
FOMC	Federal Open Market Committee
FTSE	Financial Times Stock Exchange
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
IMF	International Monetary Fund
MENA	Middle East & North Africa
MSCI	Morgan Stanley Capital International
MSX	Muscat Stock Exchange
OPEC	Organization of the Petroleum Exporting Countries

S&P 500	Standard & Poor's 500
TASI	Tadawul All Share Index
UAE	United Arab Emirates
US	United States
USD	United States dollar

LIST OF SYMBOLS

Δi^u is the unexpected target rate change

Δi^e is the expected target rate change

Δi is the actual target rate change

$f_{s,t}^0$ is the current month's futures rate on day t of month s

t is the date

s is the month

m is the number of days in a month

H_t is the stock return

i_t is the funds rate target

ε_t is the error term

r_i is the externally studentized residual

e_i is the residuals

s_i is the root mean squared error of a regression with the i th observation removed

H_i is the leverage measure

1 Introduction

The Federal Reserve sets the United States' (US) monetary policy in accordance with its mandate to effectively promote the goals of maximum employment, stable prices, and moderate long-term interest rates (The Federal Reserve, 2021). One primary tool the Federal Reserve uses to conduct monetary policy is the Federal funds rate. Raising and lowering the Federal funds rate at best has an indirect effect on macroeconomic conditions (Bernanke and Kuttner, 2005). Conversely, changes in the Federal funds rate have a direct and immediate effect on financial markets. Changes in the Federal funds rate lead to an adjustment in the rate at which firms' future cash flows are capitalized, causing stock market prices to fluctuate. Therefore, market participants and policymakers alike have a stake in understanding how financial markets respond to Federal Reserve actions and the linkages between financial and macroeconomic conditions.

Many studies have explored the effects of Federal Reserve policy actions on the US stock market (Bernanke and Kuttner, 2005). However, the effects of Federal Reserve policy actions on foreign markets have not been extensively pursued. Global financial markets are highly integrated; consequently, a shock in one market may spill over into other markets. In the year following the 2008 financial crisis, for example, economic activity declined in half of all countries in the world (International Monetary Fund, 2018). Therefore, it is important to investigate the impact of cross-border policy actions.

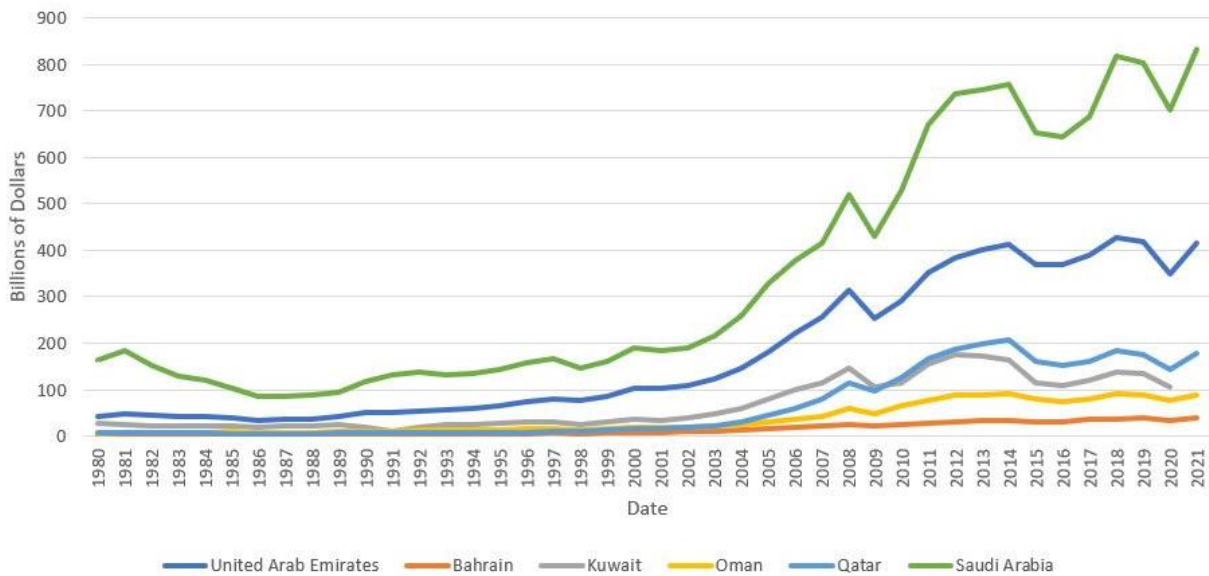
This study examines the effect of US monetary policy actions on Gulf Cooperation Council (GCC) countries' stock markets. All GCC countries, with the exception of Kuwait, maintain a fixed exchange rate regime, pegging their currency to the United States dollar (USD) (Khan, 2008). The Kuwaiti dinar is pegged to a basket of undisclosed currencies dominated by

the USD (Khan, 2008). Most of the GCC countries' revenue is generated from oil, which is denominated in USD (Khan, 2008). The respective GCC central banking authorities use repo and reverse repo rates to synchronize short-term interest rates with their dollar equivalents (Muhammad, 2008). This creates almost perfect asset substitutability between their local currencies and the USD, which means that the GCC countries' monetary policy cannot be autonomous from the policy actions of the US Federal Reserve (Muhammad, 2008).

2 Background and Literature Review

A. Background of the GCC Stock Markets

Figure 1. GCC Countries' GDP (1980–2022)



The GCC was established on May 26, 1981 (GCC, 1981). The GCC is a regional, intergovernmental, political, and economic union comprising Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates (UAE) (GCC, 1981). The GCC countries' total gross domestic product (GDP) is projected to exceed two trillion USD in 2022 (World Bank, 2022). GCC countries possess about a third of the global oil reserves (see Appendix 8.2). Combined oil and gas represent over 40% of the GDP in most GCC countries, except for UAE, in which it accounts for 30%, and Bahrain, in which it accounts for 18% (Hamdi et al., 2019). GCC countries are set to diversify their economies away from hydrocarbons. Each GCC country has developed its own strategic framework to achieve economic diversification and financial stability. This is done through the GCC countries' respective visions: Bahrain Vision 2030,

Kuwait Vision 2035, Oman Vision 2040, Qatar Vision 2030, Saudi Arabia Vision 2030, and UAE Vision 2040.

The total market capitalization of the GCC stock market exceeds 3.3 trillion USD (Appendix 8.3). Bahrain Bourse (BB) market capitalization is close to 30.2 billion USD, and the number of listed companies is 43 (Sustainable Stock Exchange Initiative, 2023). The value of the market capitalization of Boursa Kuwait (BK) is approximately 136.6 billion USD, with 167 listed companies (Sustainable Stock Exchange Initiative, 2023). Oman's Muscat Stock Exchange (MSX) has a market capitalization of approximately 58 billion USD, with 110 listed companies (Sustainable Stock Exchange Initiative, 2023). Qatar's Doha Securities Market (DSM) has a market capitalization of almost 200 billion USD, with 51 listed companies (Sustainable Stock Exchange Initiative, 2023). Saudi Arabia's Tadawul All Share Index (TASI) is the largest GCC stock exchange, with approximately 2.8 trillion USD and 227 listed companies (Sustainable Stock Exchange Initiative, 2023). The UAE's Dubai Financial Market (DFM) has a capitalization close to 111 billion USD, with 63 listed companies (Sustainable Stock Exchange Initiative, 2023). The three largest sectors across the GCC stock markets are banks, energy, and materials (Saudi Exchange, 2023).

B. Literature Review

Previous literature has analyzed the link between US monetary policy and domestic financial markets. Cook and Hahn (1989) are the first to assess the effect of monetary policy actions on market interest rates in the 1970s. The literature reflects little support for the view that the Federal Reserve can influence short-term rates. This is expected, as financial markets are

unlikely to respond to anticipated policy actions. Therefore, Kuttner (2001) proposes a technique using Federal funds futures data to categorize the changes in Federal Reserve policy actions into anticipated and unanticipated components. The study finds that interest rates' responses to anticipated target rate changes are small, while their responses to unanticipated changes are large and highly significant. Following the same technique, Bernanke and Kuttner (2005) examine the effect of changes in the US monetary policy on equity prices. They find that a hypothetical unanticipated 25-basis point cut in the Federal funds rate is associated with a one percent increase in the broad US stock market.

To the extent that global financial markets are interconnected, it is important to examine international spillovers from monetary policy actions. A number of studies have looked into the effect of US monetary policy on foreign financial markets. Wongswan (2009) analyzes the effect of US monetary policy announcement surprises on 15 foreign equity indexes in Asia, Europe, and Latin America. The results reveal that a hypothetical unanticipated 25-basis point cut in the Federal funds rate target is associated with a half to two percent increase in foreign equity indexes. Hausman and Wongswan (2011) also examine the effect of unanticipated US monetary policy announcements on foreign equity indexes, short-term and long-term interest rates, and exchange rates in 49 countries in both developed and emerging market economies. The study reveals that responses to the Federal Open Market Committee's (FOMC) actions vary greatly across countries. These cross-country variations are related to a number of factors, including the country's exchange rate regime, the size of the financial market, and the percentage of each country's equity market capitalization owned by US investors. Therefore, on average, a hypothetical surprise 25-basis point cut in the Federal funds rate target is associated with a one percent increase in foreign equity indexes and a five-basis point decline in foreign short-term

interest rates. Adopting a multivariate Generalized Autoregressive Conditional Heteroskedasticity (GARCH) technique, Abou-Zaid (2013) examines the effect of the US monetary policy on equity markets in Egypt, Israel, and Turkey. The study suggests that US monetary policy has a great influence on the equity market in Egypt but has little effect on the stock exchanges of Israel and Turkey. Overall, US monetary policy seems to have a different influence on financial markets depending on the region in focus.

Research devoted to GCC countries' economies and financial markets is scarce. Alqahtani et al. (2019) examines the effect of oil price uncertainty on the GCC stock markets using ARMA-DCC-EGARCH and time-varying student-t copula models. The study finds a significant and negative link between oil market uncertainty and the GCC stock market return. The reaction to the oil uncertainty factor differs across GCC member states, with Oman and Bahrain being relatively less sensitive. Al-Maadid et al. (2020) analyze the effect of business and political news on the GCC stock markets. Employing a Markov switching model, the results indicate the existence of significant and negative linkages between negative business news and stock returns. More importantly, the study finds that news from the largest economies not only has domestic but also cross-border negative effects. Almahfouz (2020) examines the effect of US monetary policy and the Federal Reserve's quantitative easing program on the Saudi stock market. The results show that the Federal Reserve's quantitative easing program has no influence on the Saudi stock market, but US monetary policy adjustments affect the Saudi stock market return. This study finds that a hypothetical unanticipated 25-basis point hike in the Federal funds rate is associated with a 1.75% increase in the Saudi stock market.

The current study aims to improve earlier efforts in both technique and depth. First, the study examines the response of the aggregate broad GCC countries' indexes and selective

disaggregate industry portfolios to changes in US monetary policy from June 2005 to December 2022. Second, the study attempts to isolate the surprise element of any specific change in the Federal funds rate target using a narrow daily event window. Third, following Bernanke and Kuttner (2005), the sensitivity of the results to potential outlier observations exceeding three standard deviations in magnitude is assessed. In addition, certain types of asymmetries in the market's response are examined. Finally, this study explains the economic reasons for the observed market responses related to the broad GCC equity markets.

3 Data and Methodology

A. Measuring the Surprise Element of Policy Actions

Efficient financial markets are forward-looking and react only to new information (Fama, 1970). Therefore, the GCC equity markets should react only to unanticipated changes in US monetary policy rather than respond to expected announcements. Following the technique proposed by Kuttner (2001) and Bernanke and Kuttner (2005), Federal funds futures data are used to categorize the changes in the Federal Reserve policy actions into anticipated and unanticipated components. A measure of the surprise component is derived from the change in the Federal funds futures' contract price relative to the day prior to the policy action. Specifically, the surprise or "unexpected" component, is calculated from the change in the rate implied by the current month futures contract and scaled up by a factor related to the number of days in the month affected by the change:

$$\Delta i^u = \frac{m}{m-t} (f_{s,t}^0 - f_{s,t-1}^0) \quad (1)$$

where Δi^u is the unexpected target rate change, $f_{s,t}^0$ is the current month's futures rate on day t of month s , and m is the number of days in the month. The expected component of the rate change is equal to the actual change minus the surprise:

$$\Delta i^e = \Delta i - \Delta i^u \quad (2)$$

The relevant sample includes all days when the funds rate target was changed, whether occurring in a scheduled or unscheduled emergency meeting. The first event in our sample is the FOMC meeting scheduled on June 2005, and the last event is the FOMC meeting in December 2022.

B. Equity Returns Response to Monetary Policy

Table 1
Descriptive Statistics

Table 1 summarizes the selective descriptive statistics for the GCC countries' equity markets from June 2005 to December 2022.

	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	United Arab Emirates
Number of events: rate changes and FOMC meetings	133	135	139	140	135	141
Standard deviation of equity return on event days, %	0.60	1.20	1.28	1.77	1.90	1.77
Standard deviation of equity return on nonevent days, %	0.57	1.32	0.89	1.41	1.55	1.62

¹

Changes in the Federal funds rate target are mostly associated with FOMC meetings, which usually begin around two p.m. Eastern Standard Time in the United States. This corresponds to 10:15 p.m. Arabia Standard Time, during which the GCC equity markets are closed. Due to the difference between time zones, the effect of Federal Reserve policy adjustments on the GCC equity markets is calculated using the market return on the following day. A sample of relevant events includes the combination of days when the Federal funds rate target was changed, such that the GCC equity markets were not closed the following day.

As presented in Table 1 and measured by the standard deviation, stock equity return volatility is higher on monetary policy event days than on non-event days across all GCC countries, except for Kuwait. The Bahrain stock equity return is three percentage points more volatile on event days. Unlike other GCC countries, Kuwait stock equity returns volatility is 12

¹ Total number of events vary across the GCC countries due to missing data and country-specific public holidays.

percentage points lower on event days. The stock equity returns volatility for Oman, Qatar, Saudi Arabia, and the UAE are higher on event days than on non-event by 39 percentage points, 36 percentage points, 35 percentage points, and 15 percentage points, respectively. On average, GCC equity returns show 19 percentage points higher volatility on a day when an FOMC meeting is held or a Federal funds rate change occurs. These results provide a consistent viewpoint that Federal Reserve policy actions induce a market reaction of some kind.

4 Empirical Results

A. Baseline Event Study Results

The baseline estimate for the response of the GCC equity markets to monetary policy actions is presented in Table 2. Following the technique proposed by Bernanke and Kuttner (2005), the results are based on the following regression of equity return on the raw change in the Federal funds rate target:

$$H_t = a + b\Delta i_t + \varepsilon_t \quad (3)$$

where H_t is the stock return, i_t is the funds rate target, and ε_t is the error term. The regression used for the results categorizes the effect of changes in the Federal funds rate into unexpected and expected components:

$$H_t = a + b^e \Delta i_t^e + b^u \Delta i_t^u + \varepsilon_t \quad (4)$$

where Δi_t^u is the unexpected component of the Federal funds rate change, and Δi_t^e is the expected component of the Federal funds rate change. In both specifications, the error term represents factors other than monetary policy that affect stock prices.

The study assumes that these factors are orthogonal to the Federal funds rate changes (Bernanke and Kuttner, 2005). A violation of the orthogonality assumption leads to downward-biased results (Bernanke and Kuttner, 2005). One reason for the violation of this condition is the contemporaneous response of monetary policy to GCC stock markets. However, there is no evidence of a drop in any of the GCC equity markets causing the

FOMC to cut rates². Another possible concern is if monetary policy and the stock market respond contemporaneously to new information (Bernanke and Kuttner, 2005). For example, stronger than expected economic data would plausibly send stocks higher, and make a hike in the Federal funds rate target more likely. As in the former case, the orthogonality condition would fail to hold resulting in downward-biased results (Bernanke and Kuttner, 2005). To the extent that the orthogonality condition fails, the true response of GCC countries' equity markets to monetary policy changes is understated.

Table 2
Response of Equity Prices to Federal Funds Rate Changes

Table 2 summarizes the results from the regressions of the one-day GCC equity returns on changes in the Federal funds rate (first row) and on the surprise and expected components of the funds rate change (second and third rows). The full sample contains observations from June 2005 to December 2022. All variables are expressed in percentage terms. Parentheses contain t-statistics.

Regressor	Bahrain		Kuwait		Oman		Qatar		Saudi Arabia		United Arab Emirates	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
Raw funds rate change	0.00 (-0.01)	-	0.58 (1.44)	-	1.46 (3.18)	-	1.10 (1.70)	-	0.94 (1.43)	-	-0.33 (0.54)	-
Expected change	-	0.19 (0.80)	-	0.12 (0.29)	-	0.52 (1.18)	-	-0.28 (-0.46)	-	-0.63 (-0.92)	-	-0.22 (-0.33)
Surprise change	-	-1.34 (-2.20)	-	3.73 (3.27)	-	8.02 (6.56)	-	10.92 (6.38)	-	10.46 (5.35)	-	4.19 (2.35)
Intercept	-0.27 (-0.55)	-0.04 (-0.88)	0.09 (0.94)	0.12 (1.36)	-0.16 (-1.55)	-0.09 (-0.91)	-0.12 (-0.08)	0.10 (0.77)	-0.18 (-1.09)	-0.03 (-0.19)	-0.43 (-3.07)	-0.39 (0.01)
R²	0.008	0.026	0.008	0.062	0.069	0.250	0.021	0.23	0.008	0.182	0.005	0.025

The result in the first row shows that the response of equity returns to raw Federal funds rate changes is small and statistically insignificant for all GCC countries, except Oman. For

² From January to December of 2006, on average, GCC equity markets went down by 22%. During the same year, the Federal Reserve continued pursuing an aggressive campaign of raising rates by 25 basis points on four occasions corresponding to January 31, March 28, May 10, and June 29.

Oman, a one percentage point hike in the Federal funds rate typically leads to an increase in stock prices by 1.46%. The result for Oman is statistically significant, as observed from the t-statistic of 3.18. The result in the second and third rows divides the raw target into expected and unexpected components. The response of equity prices to the expected change in the Federal funds rate is small and statistically insignificant for all GCC countries. Conversely, the response of equity prices to a surprise change in the Federal funds rate is positive and statistically significant for all GCC countries except Bahrain, where it is negative and statistically significant. A one percentage point rate hike in the Federal funds rate leads to a 1.34% decrease in BB. For Kuwait's BK, Oman's MSX, Qatar's DSM, Saudi Arabia's TASI, and UAE's DFM, a one percentage point rate hike in the Federal funds rate leads to a 3.73%, 8.02%, 10.92%, 10.46%, and 4.19% increase in equity returns, respectively. The R^2 indicates that the 2.6% of BB, 6.2% of BK, 25% of MSX, 23% of DSM, 18.2% of TASI, and 2.5% of DFM variance in equity return on these event days are associated with news about monetary policy.

Table 3**Response of Equity Prices to Federal Funds Rate Changes (Excluding Outliers)**

This table excludes outliers and reports the results from the regressions of the one-day GCC equity returns on changes in the Federal funds rate (first row) and on the surprise and expected components of the funds rate change (second and third rows). The outliers correspond to observations with influence statistics in excess of three. Parentheses contain t-statistics.

Regressor	Bahrain		Kuwait		Oman		Qatar		Saudi Arabia		United Arab Emirates	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
Raw funds rate change	0.08 (0.40)	-	0.32 (0.95)	-	0.21 (0.09)	-	-0.21 (-0.51)	-	0.81 (1.52)	-	0.30 (0.57)	-
Expected change	-	0.12 (0.58)	-	0.28 (0.80)	-	0.10 (0.42)	-	-0.18 (-0.44)	-	-0.47 (-1.00)	-	-0.26 (-0.47)
Surprise change	-	-0.18 (-0.35)	-	1.86 (0.95)	-	-1.91 (-1.53)	-	-2.14 (-0.97)	-	10.54 (8.08)	-	4.24 (2.80)
Intercept	0.00 (0.03)	0.00 (-0.05)	0.26 (0.34)	0.03 (0.37)	0.04 (0.66)	0.29 (0.53)	0.07 (0.92)	0.07 (0.83)	0.01 (0.08)	0.14 (1.42)	-0.30 (-2.49)	-0.26 (2.14)
R²	0.007	0.004	0.001	0.012	0.000	0.004	0.006	0.007	0.010	0.334	0.005	0.042

The results in Table 3 exclude observations characterized by very large changes in equity prices that exceed three standard deviations in magnitude (Appendix 8.5). The procedure used to detect potential outliers is the externally studentized residual, defined as follows:

$$r_i = \frac{e_i}{s_i \sqrt{1 - H_i}} \quad (5)$$

where e_i is the difference between the actual value y_i and the regression result \hat{y}_i . S_i is the root mean squared error with the i th observation removed. H_i is the leverage measure.

The first row shows that the response of equity returns to the raw Federal funds rate changes is small and statistically insignificant for all GCC countries. The second and third rows divide the raw target into expected and unexpected components. The results, excluding the

outlier observations, show that the response of equity prices to expected changes in the Federal funds rate is small and statistically insignificant for all GCC countries. The response of equity prices to a surprise change in the Federal funds rate is statistically insignificant for BB, BK, MSX, and DSM but is positive and statistically significant for TASI and DFM. A one percentage point surprise Federal funds rate hike leads to a 10.54% increase in Saudi Arabia's stock market. In the same manner, a one percentage point surprise rate hike is associated with a 4.24% increase in the UAE's stock market.

B. Tests for Asymmetries

Another issue concerns asymmetry, which is the possibility that the equity returns' response to monetary policy actions depends on the direction or context of the rate change. One possibility is that a positive surprise rate has a greater effect on the equity market than a negative surprise rate. A dummy variable is set to one for the observations with positive surprises. An interaction term between this dummy variable and the unexpected rate change is then included in the regression. Another possibility is that the magnitude of the market's response depends on the direction of the raw Federal funds rate change—that is, whether the Federal Reserve decides to hike, cut, or make no changes to the target Federal funds rate. The regressions are run including the full sample (Appendix 8.6) and excluding the outlier observations shown in Table 4.

Table 4**Tests for Asymmetries (Excluding Outliers)**

Table 4 summarizes the results from the regressions of the one-day GCC equity returns on the surprise and expected components of the Federal funds rate change, expressed as percentages. The positive surprise dummy is set to one when the surprise change in the funds rate is greater than zero. The no-rate change is set to one when the Federal funds rate target is unchanged. The positive rate change is set to one when the target funds rate increases. Parentheses contain t-statistics.

Regressor	Bahrain		Kuwait		Oman		Qatar		Saudi Arabia		United Arab Emirates	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
Expected change	0.12 (0.58)	0.12 (0.56)	0.34 (0.95)	0.26 (0.75)	0.09 (0.36)	0.13 (0.51)	-0.26 (-0.61)	-0.19 (-0.46)	-0.64 (-1.31)	0.60 (-1.26)	-0.44 (-0.78)	-0.33 (-0.59)
Surprise change	-0.16 (-0.30)	-0.16 (-0.29)	0.26 (0.08)	2.35 (0.81)	-1.73 (-1.02)	-2.53 (-1.62)	-1.30 (-0.50)	-2.83 (-1.15)	11.00 (8.11)	10.79 (8.11)	5.28 (3.21)	4.83 (2.97)
Surprise change x positive surprise	-0.13 (-0.08)	-	2.89 (0.65)	-	-0.45 (-0.16)	-	-3.52 (-0.62)	-	-7.72 (-1.20)	-	-7.73 (-1.59)	-
no rate change	-	-0.39 (-0.14)	-	-1.94 (-0.32)	-	10.67 (2.44)	-	5.61 (0.91)	-	0.56 (0.07)	-	-7.29 (-0.79)
positive rate change	-	-0.03 (-0.02)	-	-0.56 (-0.13)	-	-1.12 (-0.40)	-	-2.28 (-0.25)	-	-16.53 (-1.53)	-	-4.23 (-0.78)
Intercept	0.00 (-0.03)	0.00 (-0.05)	0.01 (0.07)	0.03 (0.37)	0.03 (0.55)	0.04 (0.78)	0.09 (1.00)	0.070 (0.86)	0.18 (1.72)	0.15 (1.48)	0.20 (-1.57)	-0.25 (-2.04)
R²	0.021	0.029	0.008	0.019	0.019	0.068	0.012	0.015	0.336	0.336	0.053	0.036

To the extent that the magnitude of the market's response depends on the sign of the policy surprises when the outlier observations are excluded, Table 4 provides weak evidence for this form of asymmetry across all GCC countries. The interaction terms in the third row are statistically insignificant. The table also provides weak evidence of the magnitude of the market's response being dependent on the direction of the raw Federal funds rate change. The interaction terms in the fourth and fifth rows of the table are statistically insignificant for most GCC countries. Taken together, the results in Table 4 confirm the existence of a strong one-day reaction of stock market return to unanticipated changes in the Federal funds rate for Saudi Arabia and the UAE.

C. Response of Industry Portfolios to Federal Funds Rate Surprises

The discussion above focuses on the response of the aggregate GCC equity indexes. When excluding outlier observations, changes in monetary policy do not seem to have a significant effect on the overall equity markets in Bahrain, Kuwait, Oman, and Qatar. However, changes in monetary policy do seem to have a significant effect on equity returns in Saudi Arabia and the UAE. With that said, different sectors that make up the broad equity indexes in Saudi Arabia and the UAE may have different reactions to changes in monetary policy.

Figure 2. TASI by weight (as of December 2022)

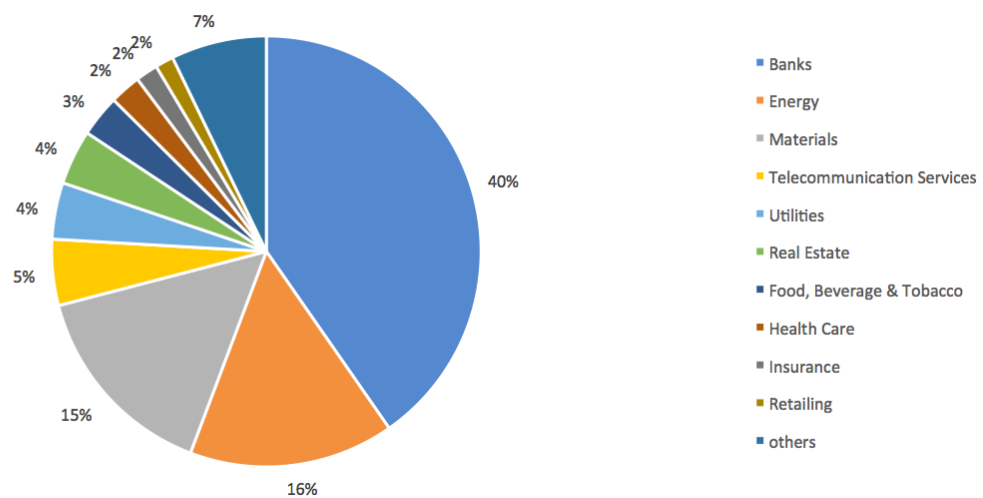


Figure 3. DFM by weight (as of December 2022)

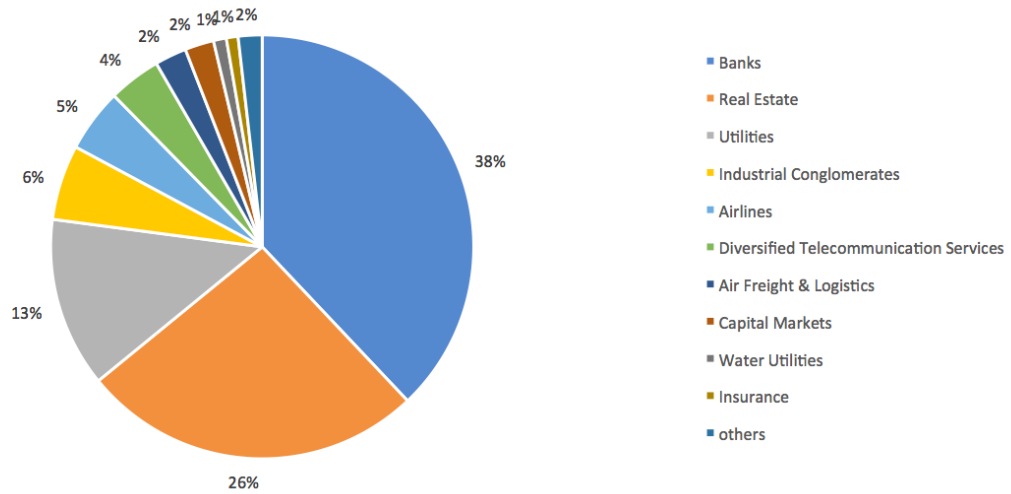


Figure 2 shows the largest industries that make up Saudi Arabia’s TASI, and Figure 3 shows the largest industries comprising the UAE’s DFM. Due to data limitations concerning TASI, we are unable to examine how its disaggregated indexes react to changes in the Federal funds rate. Nevertheless, we examine the DFM industry portfolio’s reaction to the Federal funds rate changes.

Table 5**Response of DFM Industry Portfolios to Federal Funds Rate Surprises (Excluding Outliers)**

Table 5 excludes the outlier observations and summarizes the results from the regressions of the one-day DFM equity return on changes in the industry portfolios, as indicated in the row headings, on the surprise and expected components of the changes in the Federal funds rate, all expressed in percentage terms. The sample observations are from February 2007 to December 2022, for a total of 124 observations. Parentheses contain t-statistics.

Index	Response to Federal Funds Rate Changes		R ²
	Anticipated	Unanticipated	
Banks	0.66 (1.34)	3.40 (2.53)	0.048
Financial Investment	-0.50 (-0.73)	11.44 (6.04)	0.226
Real Estate	0.31 (0.39)	7.89 (3.69)	0.088
Communication Services	-0.52 (-0.98)	12.22 (8.45)	0.365
Transportation	-0.56 (-0.90)	11.11 (6.58)	0.254
Financial Services	-0.69 (-0.76)	12.30 (4.97)	0.159
Insurance	-0.74 (-2.10)	2.73 (2.87)	0.094
Consumer Staples	0.44 (0.32)	2.76 (0.43)	0.029

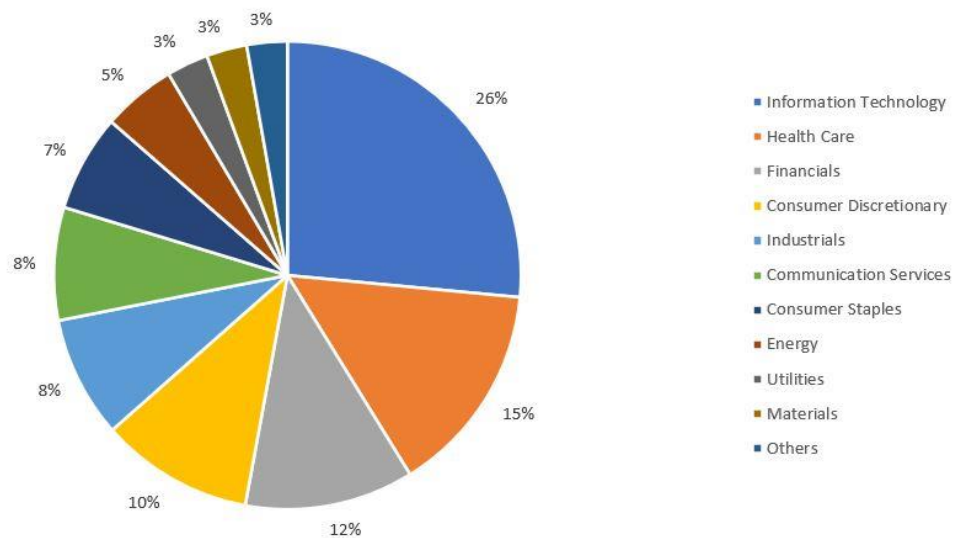
Following the procedure detailed above, Table 5 excludes observations characterized by large changes in equity prices that exceed three standard deviations in magnitude (Appendix 8.8). The response of the disaggregated indexes to anticipated rate changes is statistically insignificant across all industries, except for insurance. For the insurance industry, a one percentage point hike in the Federal funds rate typically leads to a decrease of 0.74%. The response of the disaggregated indexes to unanticipated rate changes is statistically significant across all industries, except for consumer staples. The three most responsive industries are financial services, communication services, and financial investment. All three industry

portfolios have a high R^2 , which indicates that a large portion of these industries' variance is associated with unexpected policy actions. Similar results are found for the full sample of observations (Appendix 8.7).

5 Reasons for the Observed Reaction

A more difficult question to ask is why stock prices respond as they do to monetary policy. Bernanke and Kuttner (2005) report that a hypothetical unanticipated hike in the Federal funds rate is associated with a decline in the broad US stock market. Saudi Arabia's TASI and the UAE's DFM react in the opposite direction to a hike in the Federal funds rate. In other words, a hypothetical unanticipated hike in the Federal funds rate is associated with an increase in TASI and DFM. Figure 4 shows the largest industries that make up the Standard and Poor's 500 (S&P 500) index.

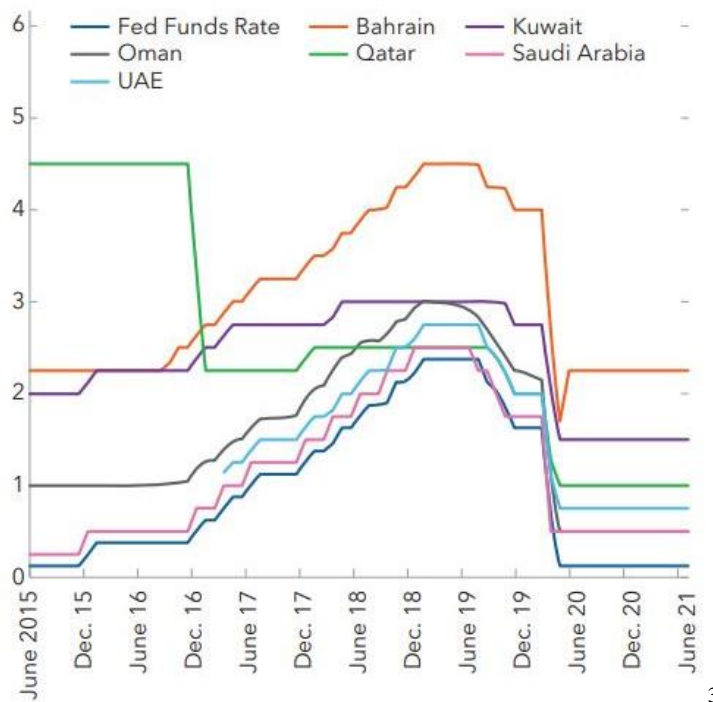
Figure 4. S&P 500 by weight (as of December 2022)



In terms of the composition of the TASI (Figure 2) and DFM (Figure 3) indexes, banks account for 40% and 38%, respectively. In comparison, the finance industry accounts for only 12% of the S&P 500. As shown in Table 5, monetary policy changes affect sectors differently. By extension, the response of each aggregate stock market index is influenced by its unique composition.

In general, an increasing interest rate environment is positive for the finance industry. Banks have large cash holdings that sit idly and cannot be lent. These are mainly used to satisfy the central banking authorities' marginal reserve requirements. For example, Saudi Arabia's reserve requirement ratio is set to 7% (CEIC, 2023). Demand deposits represent 57.9% of the 2.29 trillion SAR total deposits in Saudi banks (Argaam, 2022). Across the GCC banking system, low-cost and reliable client deposits made by customers account for almost three-quarters of the total liabilities (Moody's, 2022). Banks usually invest these cash reserves in short-term liquid securities, which, until recently, offer less attractive rates. An increasing interest rate environment helps boost the yield of short-term securities, thus increasing banks' revenue.

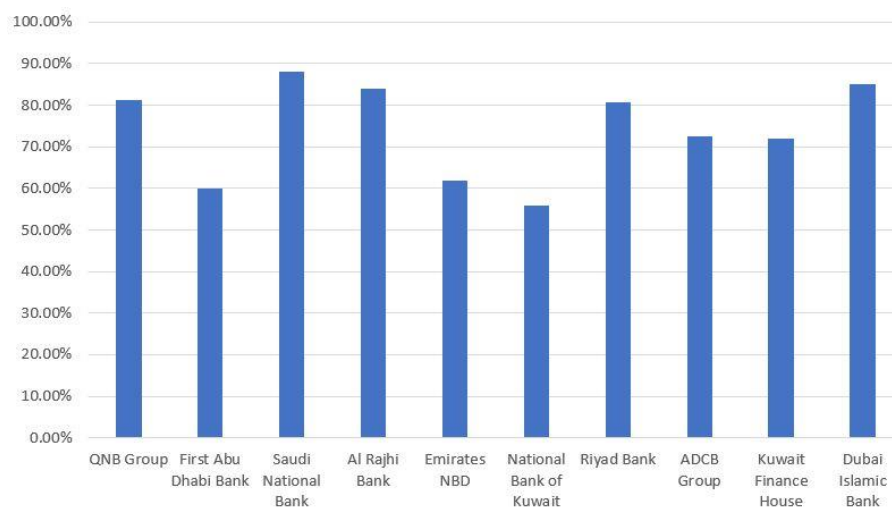
Figure 5. GCC policy rates and Federal funds rates (percent)



³ International Monetary Fund, 2022

In addition, higher interest rates expand banks' net interest margins, allowing them to generate more revenues. The net interest margin is the difference between the income from the interest charged to creditors and the interest paid to depositors. Figure 5 shows the last tightening cycle between 2015 and 2019, when the Federal Reserve, followed by the respective GCC central banking authorities, increased interest rates. The net interest margin over the same period increased by 81 pbs in Saudi Arabia (BCG, 2023). On average, banks' net interest margins across the GCC countries increased by 10 pbs over the same period (Appendix 8.9). As shown in Figure 5, the Federal Reserve reversed its policy in August 2019 and began cutting interest rates. During the period between 2019 and 2021, the net interest margin receded by 46pbs in Saudi Arabia (BCG, 2023). Across the GCC countries, the net interest margin receded by 40 pbs during the same period (Appendix 8.9). Clearly, the net interest margin moves in tandem with changes in the interest rate environment ⁴.

Figure 6. Percentage of bank income generated by interest



⁴ Between 2004 and 2006, the Federal Reserve hiked interest rates 17 times. During this period, banks' net interest margins across the GCC countries increased by 24 pbs on average. The Federal Reserve started reducing rates in June 2006, and, by the end of 2008, the target rate was reduced to zero. Across the GCC countries, the net interest margin receded by 37 pbs during the same period.

Figure 6 shows that net interest income is the primary source of income for GCC banks' and is estimated to account for approximately 74.09% of their revenues in 2021⁵. Rising net interest margins boost banks profitability and that is advantageous for aggregate equity indexes in which financial institutions account for its largest portion. Banks and financial institutions play a powerful role in helping lead and drive economic growth across all sectors in the economies of the GCC countries.

⁵ For the purpose of this paper, interest income refers to money earned by banks for lending their funds using any structure.

6 Conclusion

This study examines the effect of US monetary policy actions on the stock market returns and volatility of GCC countries from June 2005 to December 2022. Markets are unlikely to respond to anticipated policy actions. Federal funds futures data are used to distinguish between expected and unexpected policy actions. These results indicate that, on average, the GCC countries' stock markets exhibit 19 percentage points higher volatility on the days of FOMC meetings than on non-event days. We also find that a surprise change in the Federal funds rate is positive and statistically significant across all GCC countries, except Bahrain, where it is negative and statistically significant. When removing outlier observations with an influence statistic in excess of three, the response of equity prices to a surprise change in the Federal funds becomes statistically insignificant for Bahrain, Kuwait, Oman, and Qatar but remains positive and statistically significant for Saudi Arabia and the UAE. A one percentage point rate hike leads to a 10.54% increase in TASI and a 4.24% increase in DFM.

This study investigates whether GCC equities' response to monetary policy actions depends on the direction or context of the rate change. Testing for asymmetry serves both as a robustness check for the results and as a method to gauge the efficiency of GCC countries' stock markets. The magnitude of the market's response does not depend on the sign of the surprise component. In addition, the direction of the movement of the Federal funds rate target is not an important determinant of the market's reaction. These results further emphasize the existence of a strong one-day reaction of the stock market return to unanticipated changes in the Federal funds rate for Saudi Arabia and the UAE.

This study also analyzes the effect of changes in monetary policy on disaggregated industry portfolios. Due to data limitations, this study only examines how DFM industry portfolios react to Federal funds rate changes. The response of the disaggregated DFM industry portfolios to unanticipated change is positive and statistically significant for all industries, except the consumer staple. As expected, both the aggregate DFM index and the disaggregate DFM indexes react in the same way to changes in the US federal funds rate.

This study argues that the positive reactions of TASI and DFM to unanticipated rate hikes are due to several factors, mainly the composition of the indexes. The banking sector accounts for 40% of TASI and 38% of DFM. In comparison, the financials industry makes up only 12% of the S&P 500. This is important to note, as an increasing interest rate environment is advantageous to the financials industry, thus benefiting both TASI and DFM where financial institutions account for the largest portion of the aggregate indexes.

The Saudi stock market is the largest in the region, with an approximate market capitalization of 2.8 trillion USD. Only recently, in 2019, has the Saudi equity market joined global benchmark indices, including MSCI, FTSE Russell, and S&P Dow Jones. Further exploration of the effect of these recent developments on the Saudi equity market is an intriguing topic for future research.

The energy sector is the second largest across the GCC stock markets. Moreover, combined oil and gas represent over 40% of the GDP in most GCC countries. Examining the Gulf Cooperation Council countries' stock markets response to the Organization of the Petroleum Exporting Countries (OPEC) policy actions is another intriguing topic.

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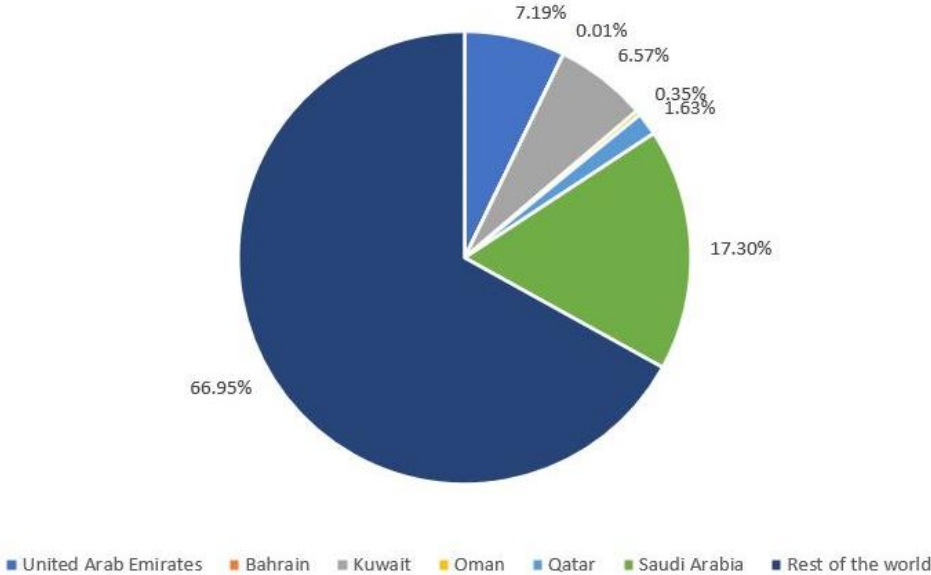
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8. Appendix

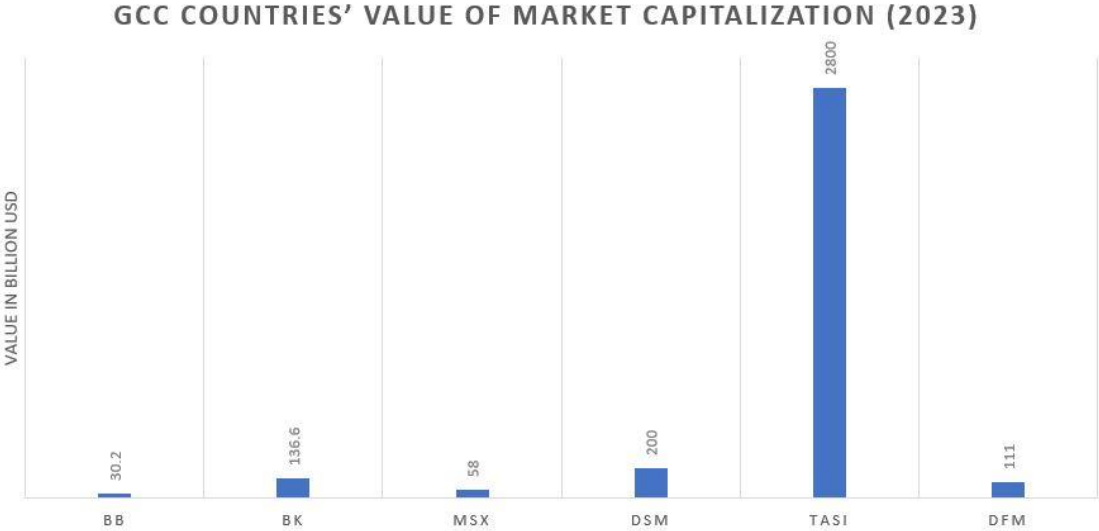
8.1. GCC Countries' Map



8.2: GCC Countries' Crude Oil Reserves (2021)

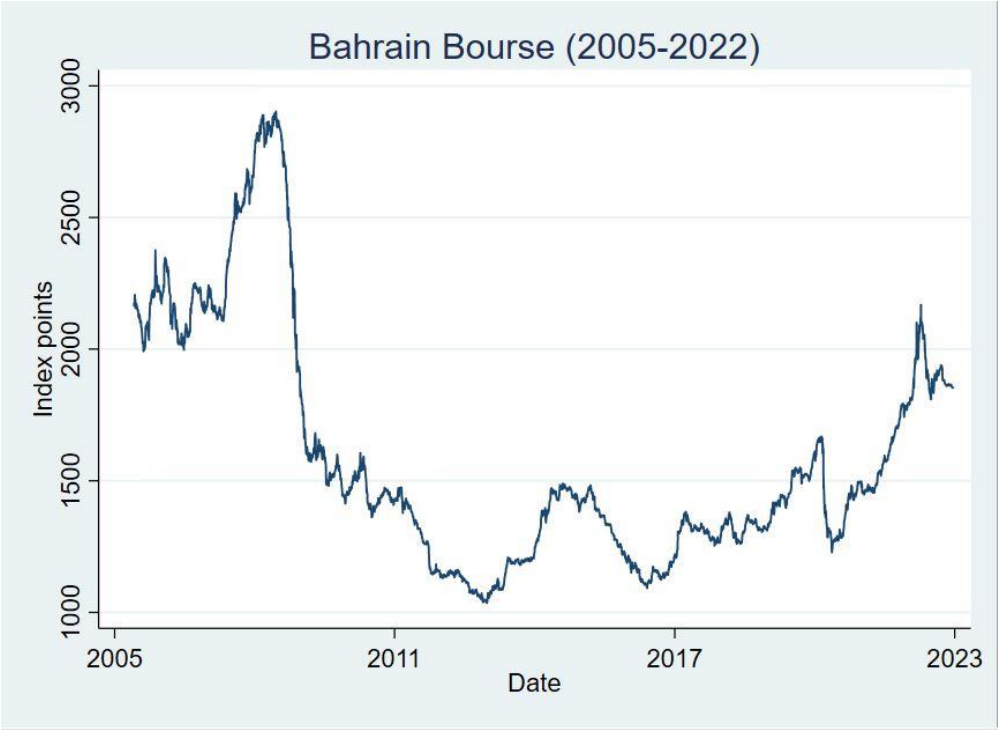


8.3 GCC Countries' Value of Market Capitalization

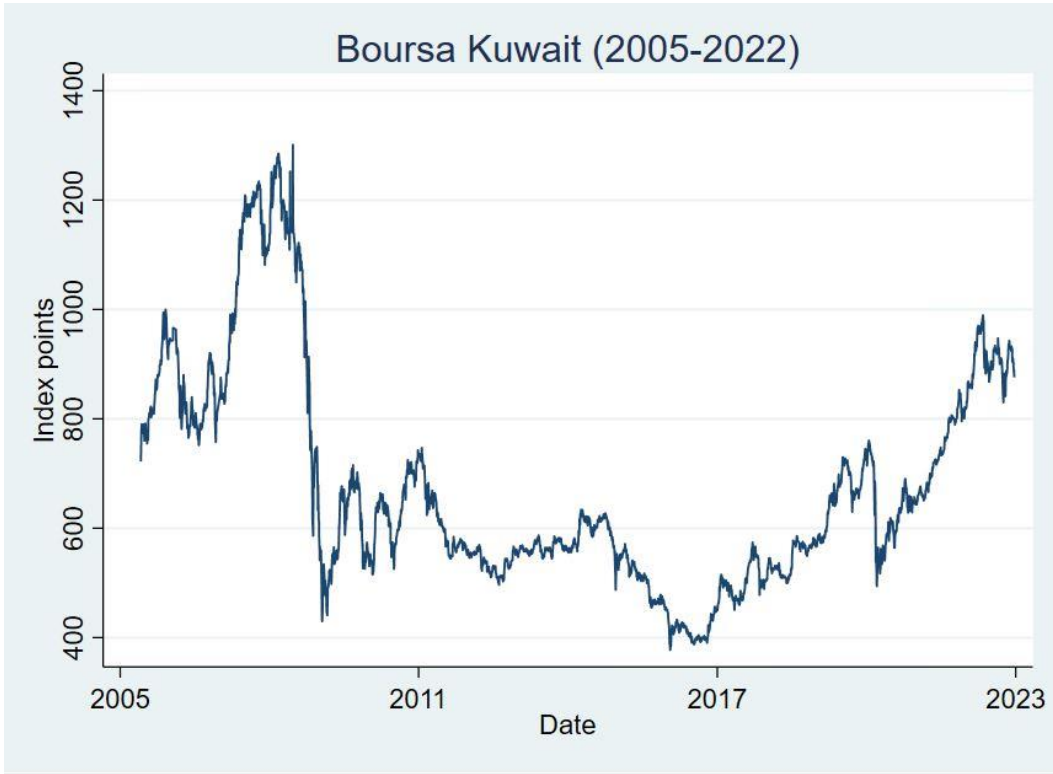


8.4: GCC Countries' Stock Indexes

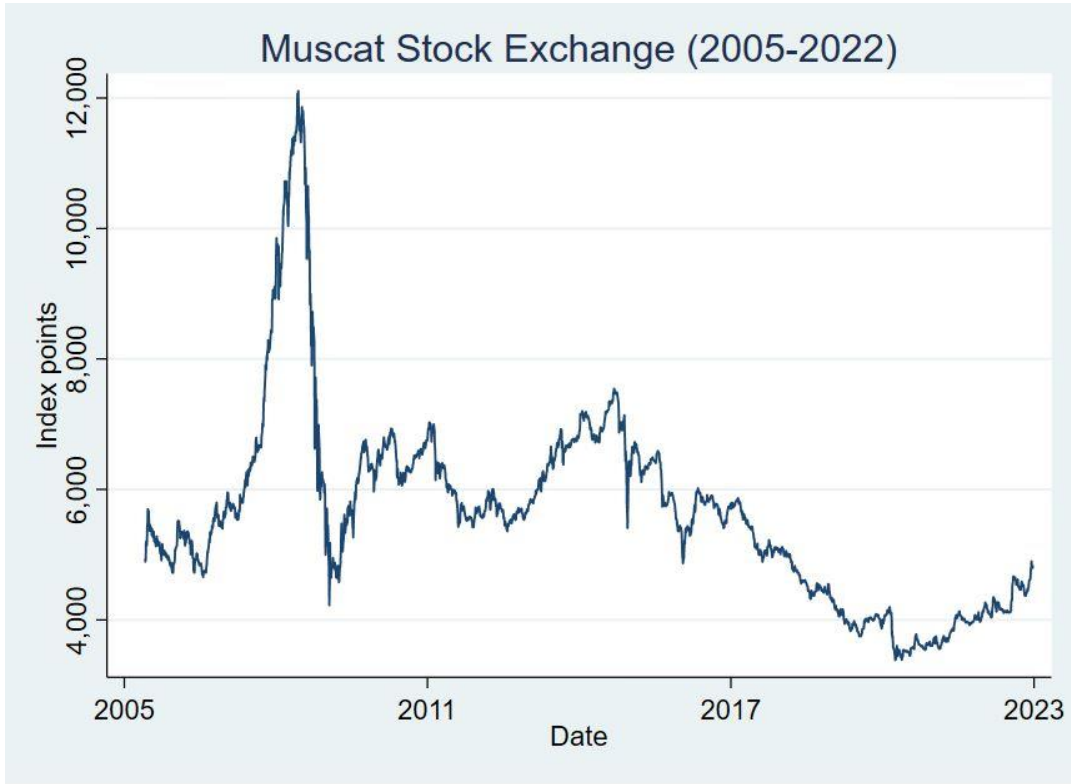
Bahrain Stock Index



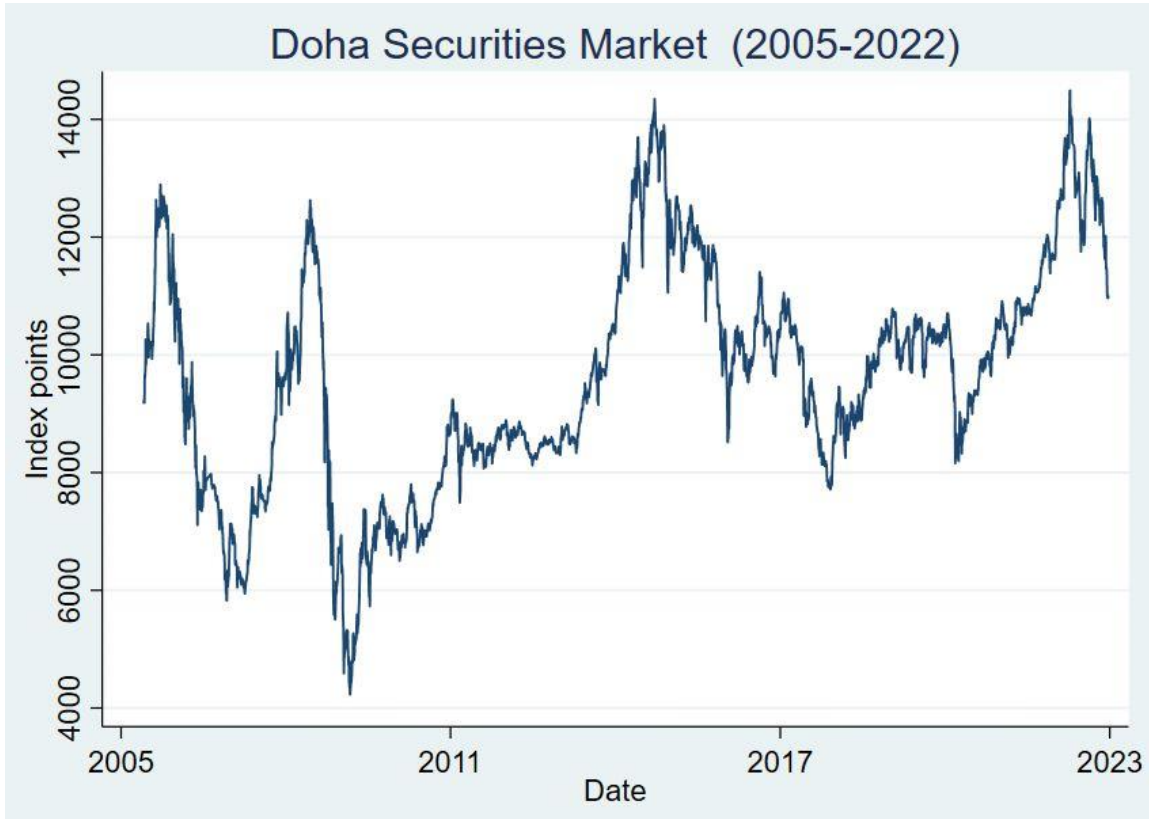
Kuwait Stock Index



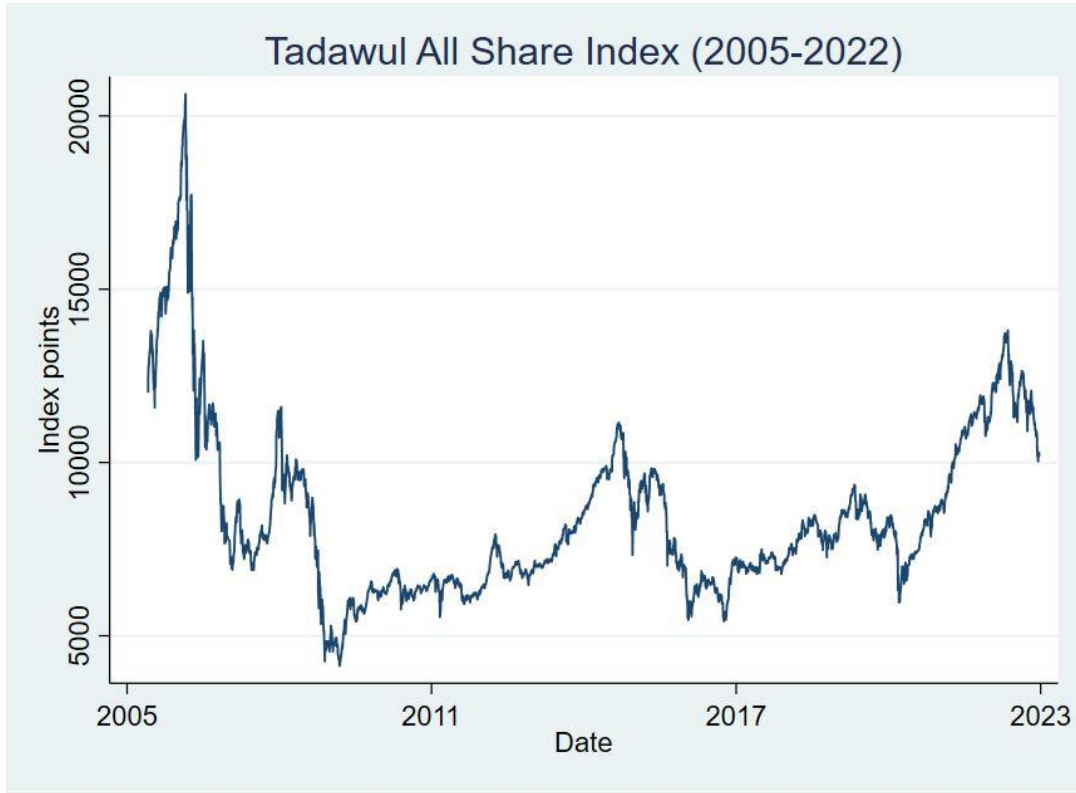
Oman Stock Index



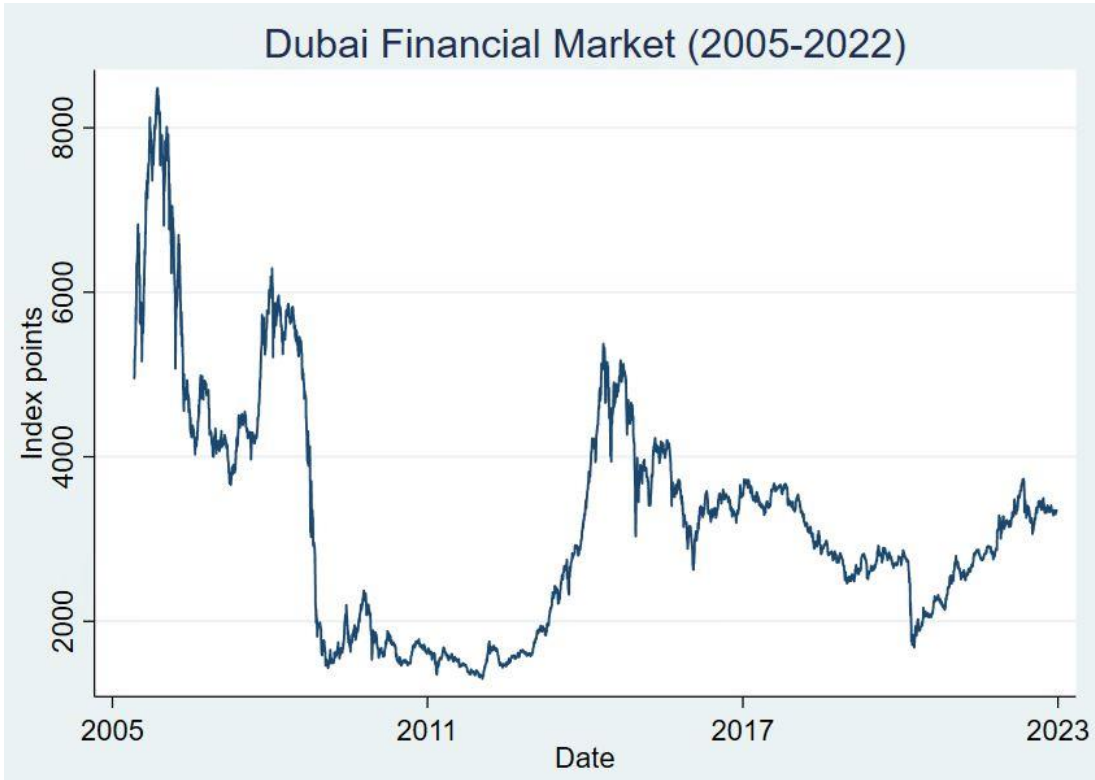
Qatar Stock Index



Saudi Arabia Stock Index



UAE Stock Index



8.5: Potential Outliers of GCC Countries' Indexes

BB Candidate Outliers

Date	Studentized Residuals
5/10/2006	-4.25
3/18/2008	-3.69
3/3/2020	3.89
3/16/2022	-3.62

BK Candidate Outliers

Date	Studentized Residuals
1/22/2008	-3.25
8/11/2009	3.23
11/4/2009	3.36
9/24/2012	3.24
3/3/2020	3.87

MSX Candidate Outliers

Date	Studentized Residuals
1/22/2008	-4.19
9/16/2008	-3.65
10/8/2008	-6.23
1/28/2009	-5.65

DSM Candidate Outliers

Date	Studentized Residuals
11/1/2005	-3.63
1/31/2006	4.54
1/22/2008	-5.11
10/8/2008	-5.60
10/29/2008	3.46
12/16/2008	3.16

TASI Candidate Outliers

Date	Studentized Residuals
5/10/2006	-4.19
9/16/2008	-4.67
10/8/2008	-3.71
10/29/2008	3.21
12/17/2014	-4.92

DFM Candidate Outliers

Date	Studentized Residuals
6/24/2009	-3.47
11/4/2009	-3.01
12/17/2014	-4.81

Table 8.6: Tests for Asymmetries

Regressor	Bahrain		Kuwait		Oman		Qatar		Saudi Arabia		United Arab Emirates	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
Expected change	0.13 (0.54)	0.22 (0.93)	0.68 (0.16)	0.08 (0.19)	0.20 (0.47)	0.35 (0.81)	-0.85 (-1.44)	-0.55 (-0.94)	-1.15 (-1.64)	-0.82 (-1.19)	-0.41 (-0.62)	-0.26 (-0.40)
Surprise change	-1.03 (-1.56)	-1.61 (-2.46)	4.04 (3.24)	4.09 (3.33)	9.90 (7.77)	9.52 (7.52)	14.23 (1.73)	13.34 (7.66)	12.04 (6.01)	11.48 (5.82)	5.30 (2.74)	4.59 (2.40)
Surprise change x positive surprise	-2.33 (-1.19)	-	-2.33 (-0.63)	-	-13.95 (-3.70)	-	-24.52 (-4.78)	-	-23.90 (-2.62)	-	-8.25 (-1.44)	-
no rate change	-	1.04 (0.29)	-	-3.43 (-0.52)	-	-11.25 (-1.67)	-	-10.54 (-1.13)	-	-9.31 (-0.58)	-	-2.56 (-0.25)
positive rate change	-	2.62 (1.20)	-	-2.75 (-0.67)	-	-12.69 (-2.99)	-	-23.09 (-3.96)	-	-25.90 (-2.46)	-	-3.54 (-0.55)
Intercept	0.03 (-0.48)	-0.49 (-1.00)	0.14 (1.48)	0.13 (1.40)	0.02 (0.22)	-0.06 (-0.63)	0.30 (2.25)	0.16 (1.24)	0.11 (0.67)	-0.37 (-0.25)	-0.32 (-2.20)	-0.38 (-2.67)
R²	0.030	0.022	0.058	0.053	0.319	0.308	0.327	0.294	0.205	0.196	0.033	0.013

8.7: Response of DFM Market Industry Portfolios to Federal Funds Rate Surprises

Index	Response to Federal Funds Rate Changes		R ²
	Anticipated	Unanticipated	
Banks	1.05 (1.87)	4.59 (3.00)	0.080
Financial Investment	0.17 (0.17)	14.01 (5.23)	0.170
Real Estate	0.79 (0.92)	9.51 (4.06)	0.111
Communication Services	-0.11 (-0.17)	13.57 (7.88)	0.325
Transportation	0.05 (0.07)	12.85 (6.62)	0.251
Financial Services	0.13 (0.12)	14.79 (5.03)	0.157
Insurance	-0.20 (-0.47)	3.41 (2.88)	0.049
Consumer Staples	3.02 (2.02)	6.99 (0.92)	0.048

8.8: DFM Disaggregated Index's Potential Outliers

DFM Bank Portfolio Candidate Outliers

Date	Studentized Residuals
10/08/2008	-5.23
4/27/2011	3.19

DFM Financial Investment Portfolio Candidate Outliers

Date	Studentized Residuals
10/8/2008	-4.21
11/3/2021	3.13

DFM Real Estate Portfolio Candidate Outliers

Date	Studentized Residuals
10/8/2008	-4.21
11/3/2021	3.13

DFM Communication Service Portfolio Candidate Outliers

Date	Studentized Residuals
10/8/2008	-4.93
4/29/2009	3.37
9/23/2009	3.21

DFM Transportation Portfolio Candidate Outliers

Date	Studentized Residuals
10/8/2008	-6.70

DFM Financial Service Portfolio Candidate Outliers

Date	Studentized Residuals
10/8/2008	-5.79
4/25/2012	3.80

DFM Insurance Portfolio Candidate Outliers

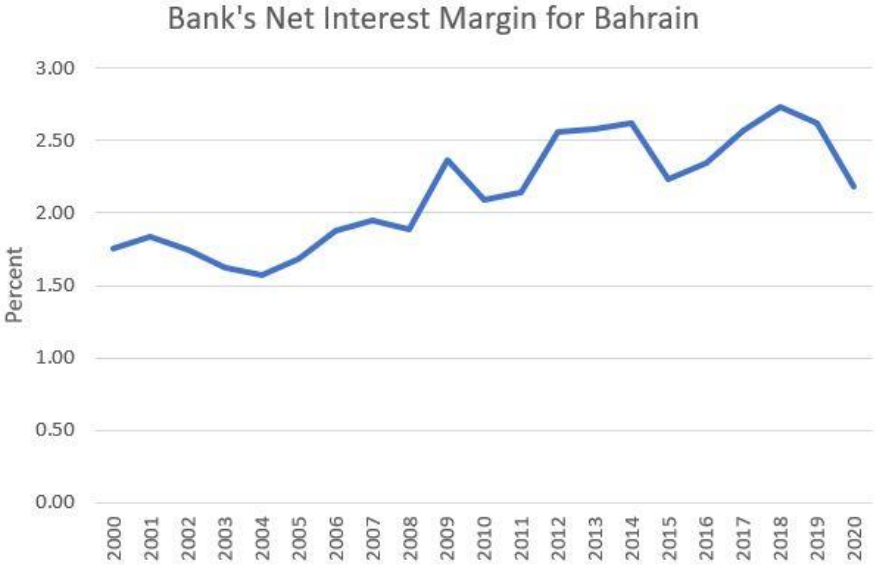
Date	Studentized Residuals
10/8/2008	-4.42
3/16/2022	6.20

DFM Consumer Staple Portfolio Candidate Outliers

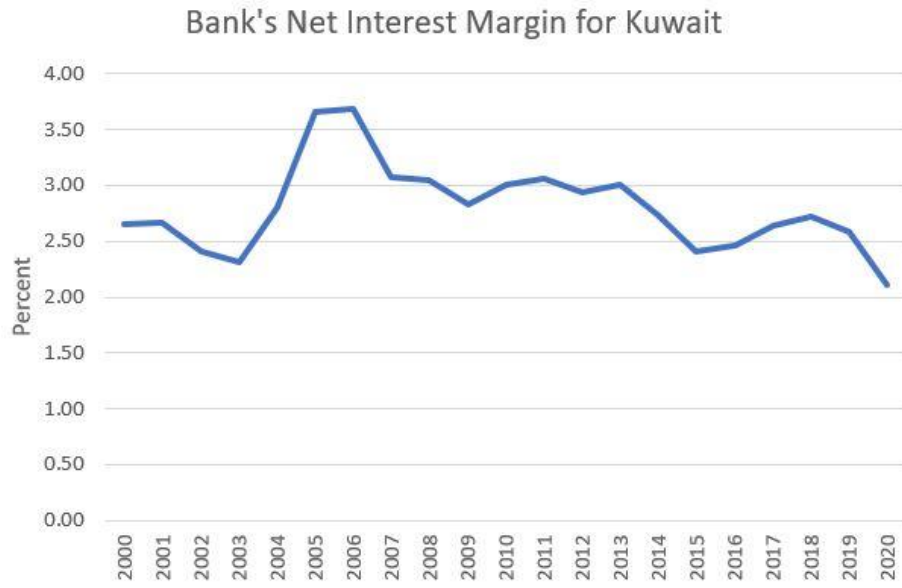
Date	Studentized Residuals
6/15/2022	5.04

8.9: GCC Countries' Bank's Net Interest Margin

Bahrain Bank Net Interest Margin

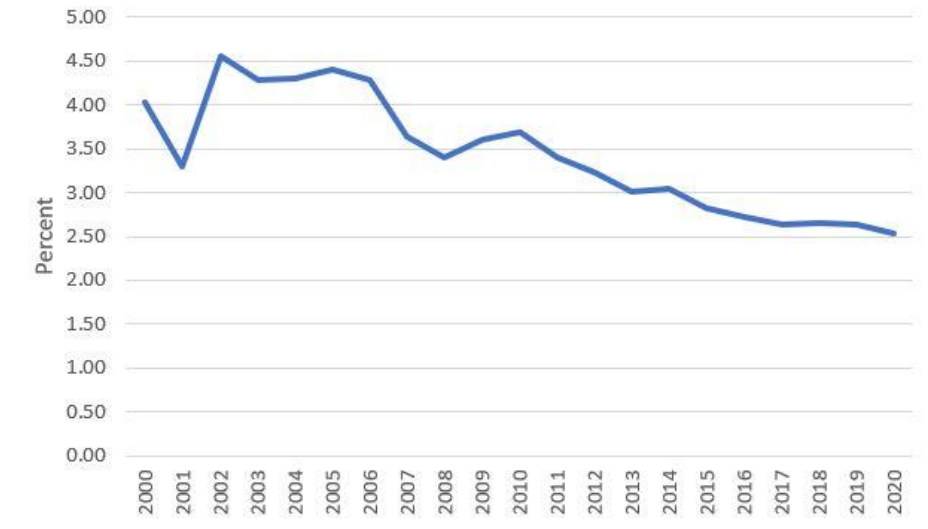


Kuwait Bank Net Interest Margin



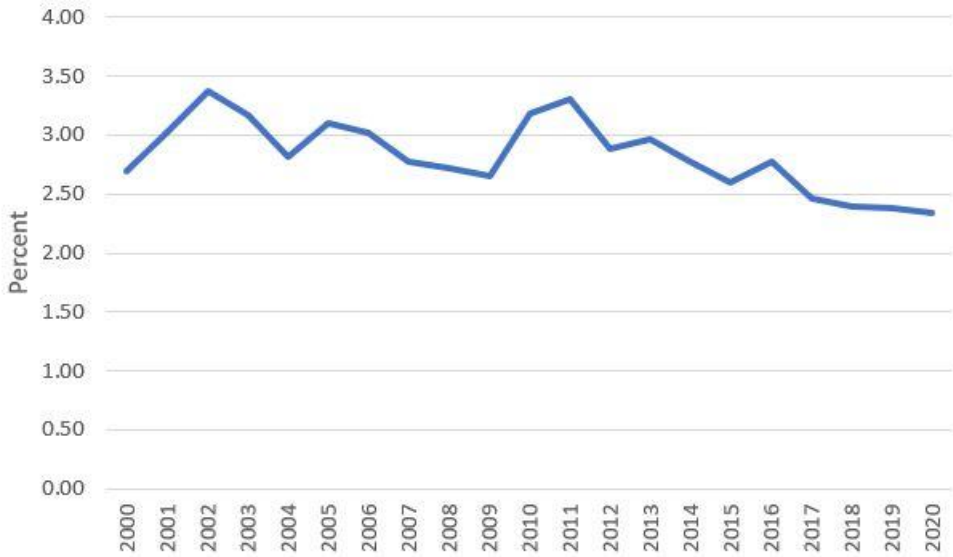
Oman Bank Net Interest Margin

Bank's Net Interest Margin for Oman

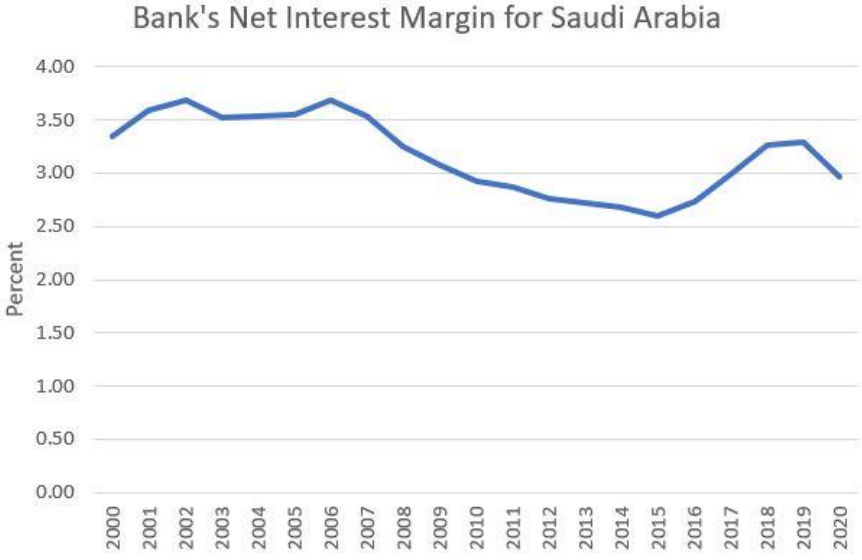


Qatar Bank Net Interest Margin

Bank's Net Interest Margin for Qatar



Saudi Arabia Bank Net Interest Margin



UAE Bank Net Interest Margin

