Further Exploration of "Oil, Foreign Exchange Swaps and Interest Rates in the GCC Countries"

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Abstract

In Almaskati (2022b) study, it was mentioned that there is a correlation between oil prices, foreign exchange (FX) swaps, and interest rates among the member countries of the Gulf Cooperation Council (GCC). The study found that oil prices indeed influence indicators such as forward exchange transactions, with Saudi Arabia showing the greatest spillover effect in forward exchange transactions among GCC member countries. Since the study covers the period from 2005 to 2020 and focuses on GCC member countries, there is a plan to extend it in two directions: incorporating data from 2020 to 2023 and including other energy like natural gas. The plan involves using a vector autoregression model (VAR) to regress oil prices, FX swaps, local interbank rates, SP500, gold prices, gas, and London interbank offered rates (LIBOR), and determining the lag period using Akaike Information Criterion (AIC) and the Bayes Information Criterion (BIC). Subsequently, Granger causality tests will be conducted to examine the causal relationships within these variables.

Keywords: GCC markets, oil, FX swaps, interest rates, VAR model

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1 Introduction

For oil-producing countries like the Gulf Cooperation Council (GCC), the majority of their foreign exchange comes from revenue generated by oil exports, making oil prices closely intertwined with foreign exchange swaps (FX swap). Additionally, since oil exports constitute a significant portion of GDP and government revenue, and government entities, public investment funds, and sovereign wealth funds are major liquidity providers for local banks, there should be a significant correlation between oil prices, FX swap, and interest rates. Therefore, the research question will focus on "whether oil prices affect FX swap and interest rates, and if so, how?"

The main reference, Almaskati (2022b), investigates the relationship between oil prices, FX swaps, and local interbank offered rates across the six Gulf Cooperation Council (GCC) countries. It explores the potential hedging and diversification benefits of including oil in portfolios containing GCC FX swaps or interest rate instruments. The study finds that oil and oil-related exports are significant sources of USD liquidity and government funding in GCC economies, with oil prices predicting movements in GCC FX swaps and interbank offered rates. Specifically, the Saudi Arabian FX swap market has a notable influence on other GCC markets due to the country's dominant role in the region's economy.

This study contributes to the understanding of the relationship between oil and GCC FX swaps and interbank rates, offering insights valuable for

trading and risk management decisions in the GCC market. Besides, we consider natural gas due to its complex relationship with oil. Natural gas, as a by-product of oil production, should exhibit a positive correlation with oil prices. However, at the same time, natural gas also serves as a substitute for oil in the energy market, as seen in recent decades with the emergence of technologies such as gas-powered vehicles and natural gas power generation.

2 Related Literature

Since this study was published in 2020, there are relatively fewer related studies. I have highlighted several studies that are highly relevant to it. Amano and Van Norden (1998) observed that the trends in oil prices significantly impact the real exchange rate of the United States. Zhang et al. (2008) noted a long-term correlation between oil prices and the US dollar exchange rate, suggesting that it is the US dollar exchange rate that influences oil prices. Reboredo, Rivera-Castro, and Zebende (2014) found a long-term contagion effect between oil prices and the US dollar exchange rate, exacerbating the 2008 global financial crisis. Eslamloueyan and Kia (2015) discovered that oil prices play a crucial role in determining the real exchange rates of GCC member countries in the long term. The original author, Almaskati (2022a), employed wavelet analysis to examine the relationship between oil prices and forward exchange rates. This study found that the relationship between the two is small but significant at high frequencies, and strong and significant

at low frequencies. Notably, there is no significant relationship between the two during periods of rising oil prices.

3 Data

We extracted the daily closing prices of several financial assets from Datastream during the period from May 2009 to May 2024. As GCC foreign exchange swap and/or interest rate data were not available before this period, we limited the time frame of our analysis. We calculated the continuously compounded daily returns as $\log \frac{P_t}{P_{t-1}} \times 100$, where Pt is the daily closing price. Unless otherwise stated, all analyses in our study are based on these returns. The variables extracted include: three-month forward foreign exchange levels for all GCC markets and the euro; the United Arab Emirates (EIBO3M), and the London Interbank Offered Rate (USDL3M); spot and futures commodity prices (oil/gold/gas); the SP 500 U.S. stock index (SPX); and the MSCI Emerging Markets Index (MSCI-EM). As foreign exchange swap prices are affected by the actual term day count (three months in our case), which can vary from day to day due to holidays or calendar effects (e.g., 90 or 93 days), we adjusted the prices to be all based on 91 days. In addition, we used forward prices (i.e., foreign exchange spot prices adjusted by foreign exchange swap points) in our analysis, not just pure foreign exchange swap prices, as using the latter alone could distort the situation, especially in estimating daily volatility and return sizes.

In this study, we refer to foreign exchange swap variables by their abbreviations, which represent the currency and term, such as AED3M (three-month UAE forward foreign exchange swap). Our analysis focuses on the three-month foreign exchange swap term, as this is the most liquid and actively quoted/traded term in FX swap. We also limited our analysis of local interbank lending rates to the rates in the United Arab Emirates, as interest rate derivatives are only quoted for these two rates, and there is a lack of reliable and actively used interbank lending rates in other GCC markets. The addition of other international variables (USDL3M/gold/SPX/MSCI-EM) is for comparison of the role of oil versus these variables in hedging GCC foreign exchange swap and interest rate exposures.

4 Methodology

We regress oil prices, FX swap, local interbank offered rates, SP500, gold prices, and LIBOR using a vector autoregression model (VAR). We determine the lag order using the Akaike Information Criterion (AIC) and the Bayes Information Criterion (BIC), and then conduct Granger causality tests to examine the causal relationships between these variables.

Let , where $\mathbf{y}_t$ represents the vector of all variables, including changes in log FX swap, changes in log interbank rates, changes in log oil prices, and so on. The VAR model is represented as:

$$\mathbf{y}_t := (\Delta \log \mathrm{FXswap}_t, \Delta \log \mathrm{r}_t, \Delta \log \mathrm{Oil}_t, ...)^T \in \mathbb{R}^p,$$

$$\mathbf{y}_t = \mathbf{A}_{-1}\mathbf{y}_{t-1} + \mathbf{A}_{-2}\mathbf{y}_{t-2} + ... + \mathbf{A}_{-k}\mathbf{y}_{t-k} + e_t,$$

where $\mathbf{A}_{-k}$ is the coefficient matrix of lag k, e_t represents the white noise error term.

5 Data Analysis

In table 1, we present the summary statistics of the variables used in our analysis. The table shows the mean, maximum, minimum, standard deviation, skewness, kurtosis, and the p-value of Jarque-Bera statistic, Augmented Dickey-Fuller (ADF) test, and Phillips-Perron (PP) test for each variable. The Jarque-Bera statistic tests the null hypothesis that the data is normally distributed, while the ADF and PP tests examine the null hypothesis that the data has a unit root. The results of these tests are all statistically significant, indicating that the data is not normally distributed and does not have unit root.

Table 1: Summary Statistics of the Return rates

Name	Mean	Maximun	Minimun	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	ADF	PP
OMR3M	0.000368	4.580394	-3.126833	0.321510	1.127371	33.667119	0.000000	0.000000	0.000000
BHD3M	0.000178	1.471405	-1.590376	0.152445	-0.123410	16.192026	0.000000	0.000000	0.000000
KWD3M	-0.000181	2.921430	-2.821397	0.241882	-0.075060	18.478365	0.000000	0.000000	0.000000
QAR3M	0.000023	5.930881	-5.955600	0.300399	-1.029339	125.294164	0.000000	0.000000	0.000000
SAR3M	0.000030	0.435031	-0.461680	0.025713	0.564578	75.888848	0.000000	0.000000	0.000000
AED3M	-0.000012	0.295667	-0.258926	0.012378	0.727567	171.852696	0.000000	0.000000	0.000000
EUR3M	-0.005693	2.567288	-2.242401	0.527834	0.047230	1.589542	0.000000	0.000000	0.000000
EIBO3M	0.019403	44.497508	-49.061664	4.340056	-0.578778	33.842150	0.000000	0.000000	0.000000
Gold	0.023873	5.133427	-9.596165	0.971210	-0.455444	5.634502	0.000000	0.000000	0.000000
Oil	-0.020409	123.677917	-305.966065	5.886999	-33.463558	1913.033934	0.000000	0.000000	0.000000
MSCI EM	0.011127	5.581817	-6.943303	1.026245	-0.399815	3.778718	0.000000	0.000000	0.000000
SPX	0.045251	8.968316	-12.765214	1.081019	-0.707849	13.183011	0.000000	0.000000	0.000000
USDL3M	0.047995	24.885484	-27.263636	1.702867	-0.801945	48.911574	0.000000	0.000000	0.000000
GAS	-0.032772	38.172675	-69.314718	3.662205	-1.330571	39.500504	0.000000	0.000000	0.000000

In Table 2, we present the correlation matrix of the variables used in our analysis. We notice the presence of relatively higher positive correlations among the various commodities (oil/gold/gas) and equity markets (MSCI-EM and SP500). The table shows the correlation coefficients between each pair of variables. The results show that oil prices have a positive correlation

Table 2: Correlation of the Return rates

	OMR3M	BHD3M	KWD3M	QAR3M	SAR3M	AED3M	EUR3M	EIBO3M	Gold	Oil	MSCI EM	SPX	USDL3M	GAS
OMR3M	1.000000													
BHD3M	0.064175	1.000000												
KWD3M	-0.004342	0.048295	1.000000											
QAR3M	-0.032026	0.014369	0.021553	1.000000										
SAR3M	0.075297	0.038707	0.016946	0.024471	1.000000									
AED3M	0.073529	0.018838	0.087568	0.002695	0.064088	1.000000								
EUR3M	0.007711	0.010918	-0.202587	0.010328	0.000726	-0.025512	1.000000							
EIBO3M	-0.011979	-0.014450	-0.010113	-0.013793	0.013951	-0.004707	0.021393	1.000000						
Gold	0.037293	0.004764	-0.084953	0.002930	0.003426	-0.016769	0.363884	0.023088	1.000000					
Oil	0.058072	0.036930	-0.018069	-0.002890	0.082453	0.014696	0.049036	-0.000047	0.045790	1.000000				
MSCI EM	-0.000011	-0.000820	-0.064095	-0.016388	-0.003269	0.012727	0.292853	-0.004832	0.210766	0.100368	1.000000			
SPX	0.047305	-0.009077	-0.067865	-0.029824	0.027595	-0.007703	0.162321	-0.009381	0.068460	0.138281	0.453554	1.000000		
USDL3M	0.042462	-0.031377	-0.007134	-0.033063	-0.000350	-0.014125	-0.070792	-0.018465	-0.078611	-0.023823	-0.041639	0.009709	1.000000	
GAS	-0.012172	0.004382	-0.025919	0.024487	0.017694	-0.015924	0.024572	-0.034489	0.000870	0.005898	0.042040	0.070901	-0.025984	1.000000

with EUR3M, gold, and the SP500 index. The correlation between oil prices and FX swaps is relatively low, which is consistent with the findings of the original study.

6 Results

We find that the AIC and BIC results are quite different. The AIC suggests a lag of 9, while the BIC suggests a lag of 2. We choose the lag of 2 as it is more conservative. The results of the VAR model are presented in Table 3. The results show that the impact of lag 1 and lag 2 of OMR3M on oil price is significant, largest, and negative. Besides, SAR3M has the largest and significant positive impact on OMR3M. Third, the impact of lag 1 of AED3M on KWD3M is significantly large. The results are quite different from Almaskati (2022b), which found that the impact of oil price on FX swaps and interest rates is quite significant. On the contrary, we find that the impact is reversed.

In Table 4, we present the results of the Granger causality tests. The

Table 3: VAR Model Results($\alpha = 5\%$)

	OMR3M	BHD3M	KWD3M	QAR3M	SAR3M	AED3M	EIBO3M	Oil	USDL3M
L1.OMR3M	-0.388544	0.026061	0.035832		0.002620			-0.773951	
L1.BHD3M	0.093795	-0.415733							
L1.KWD3M	0.043305		-0.258733			-0.001989			0.320108
L1.QAR3M	0.036584			-0.445284			0.469332		
L1.SAR3M	0.584286	0.256249			-0.428796	0.016081			
L1.AED3M			-1.053435			-0.559541			
L1.EIBO3M	-0.002523						-0.367572		0.027283
L1.Oil								-0.253198	
L1.USDL3M							0.204014		0.132099
L2.OMR3M	-0.092432		0.039735				-0.463412	-1.363542	
L2.BHD3M		-0.171601							
L2.KWD3M	0.048206	0.021473	-0.093834		0.004291				
L2.QAR3M				-0.159426				-0.854648	
L2.SAR3M					-0.239815				
L2.AED3M						-0.285123			
L2.EIBO3M							-0.140055	0.055453	0.012622
L2.Oil	-0.002001		-0.001964		-0.000847			-0.123944	
L2.USDL3M							0.181734		0.208902

results show that oil prices Granger-cause OMR3M, SAR3M, and KWD3M. The results also show that OMR3M, SAR3M, KWD3M, and EIBO3M Granger-cause oil prices. This suggests that when considering only oil and one FX swaps of one country, oil prices have predictive power over the FX swaps of Oman, Kuwait, and Bahrain. However, when we introduce covariates such as other countries' FX swaps into the model, the predictive power of oil prices on FX swaps is reduced or even negligible. The combined results further imply that the Granger causality relationship between oil prices and FX swaps is biased by the omitted variable, which is the FX swaps of other countries.

Table 4: Granger Causality Test Results

Variable	Causality direction	Variable	p value
Oil	$\rightarrow / \leftarrow$	AED3M	0.11/0.67
Oil	$\rightarrow / \leftarrow$	BHD3M	0.67/0.31
Oil	$\rightarrow / \leftarrow$	OMR3M	0.00/0.03
Oil	$\rightarrow / \leftarrow$	QAR3M	0.12/0.48
Oil	$\rightarrow / \leftarrow$	SAR3M	0.00/0.00
Oil	$\rightarrow / \leftarrow$	KWD3M	0.03/0.01
Oil	$\rightarrow / \leftarrow$	EIBO3M	0.48/0.03

7 Summary

In this study, we examine the relationship between oil prices, FX swaps, and interest rates in the GCC countries. We find that FX swaps have a significant impact on oil prices, but interest rates do not. The FX swaps of these countries, Oman and Qatar, impact oil prices the most. The results are quite different from the original study, which found that the causality is reversed. The powerful impact of Oman and Qatar's FX swaps on oil prices is a mystery that requires further investigation. One possible reason is that oil prices are more sensitive to the political status of these countries. For example, the civil war in Yemen may have a significant impact on its neighbor, Oman, and global oil production. Another reason is that our dataset (2009-2024) is quite different from the original study (2005-2020). The 2008 financial crisis and the 2020 COVID-19 pandemic may have significantly impacted the relationship between oil prices and FX swaps.

8 comment

As mentioned in the Abstract, this proposal will adopt an approach that extends the time and spatial scale, incorporating data from 2020 to 2023, and also includes data like gas. The exchange rates in the data will be based on three months (91 days), and all data will be processed as $100 \times \log \frac{P_t}{P_{t-1}}$. All of the above data will be obtained from Datastream.

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