Testing Monetary Policy Trilemma for Middle Eastern Economies under a Bayesian Panel VAR

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Testing Monetary Policy Trilemma for Middle Eastern Economies under a Bayesian Panel VAR Specification

by

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Abstract

Middle Eastern economies follow the dollar-pegged exchange rate policy with an open capital account, and this poses a question regarding the autonomy of the monetary policy stance adopted by the regional central banks. In this context, the current research aims to evaluate the ‘monetary policy trilemma’ whilst using the Bayesian panel vector autoregression approach. In considering four variables, namely domestic interbank interest rate, domestic liquidity, oil price and federal funds rate, the present research finds that a positive shock in US federal funds rate increases the domestic interest rates in the Middle Eastern economies. Additionally, this research finds a negative relationship between the oil price shocks and the domestic interest rates, but, conversely, a positive shock in US federal funds rate induces a reduction in the oil price. The current project is unique, as it examines the monetary policy trilemma whilst considering oil price as a control variable in the system under a time-varying Bayesian panel vector autoregression specification. It provides insights that policymakers can use to determine the autonomy of the domestic monetary policy stance, so as to achieve the broader macroeconomic objectives of that policy.

Key Words: monetary policy, trilemma, oil prices, Middle East, United States

JEL Classification: E43, E52, F41

Declarations of interest: none

1. Introduction

Middle Eastern economies are more sensitive to any change in the US monetary policy, as their economies have pegged their currencies to the US dollar. However, these countries are trapped in a ‘monetary policy trilemma’, with capital account openness and pegged exchange rate regimes. The spillover of any change in the stance of US monetary policy affects the policies of regional central banks in the Middle East. The conventional Mundell-Fleming trilemma, also known as the impossible or inconsistent trinity, implies that a country cannot
simultaneously maintain capital mobility, a fixed exchange rate, and an independent monetary policy (Froyen and Guender, 2022). For instance, if a country with a fixed exchange rate and perfect capital mobility adopts a contractionary monetary policy to reduce inflation, this will result in higher capital inflows, and demand for domestic currency will increase, which will in turn compel the central bank to sell domestic currency in order to maintain the stable exchange rate. Therefore, if a country follows the fixed exchange rate regime with an autonomous monetary policy, then it cannot allow capital mobility across borders. Conversely, if a country allows capital mobility with a fixed exchange rate, then it needs to compromise on monetary autonomy. And finally, if a country wants to have an independent monetary policy with capital mobility, then it should adopt a flexible exchange rate regime. This historic Mundell and Fleming analysis is based on the Keynesian model of a simple open economy with only one type of interest-earning asset.

The Middle Eastern economies constitute a classic case, as they keep a regime of pegged exchange rate with cross-border capital flows and, consequently, any change in the US monetary policy stance is transmitted to the regional monetary policy stance in the Middle East. Earlier studies found that an increase of 150 basis points in the federal funds rate reduced the non-oil economic activity in Middle Eastern countries by 1.5 % with a time lag of 2 years (Prasad and Khamis, 2011). In this context, the current research aims to examine the spill over effects of the US monetary policy on the domestic monetary policy of selected Middle Eastern countries by using the time-varying Bayesian panel vector autoregression model. This paper is unique, since it relates the size of US monetary policy spillover with oil price level, as changes in oil prices are the key factor in influencing the cross-border transmission of US monetary policy. Additionally, changes in oil prices can significantly alter the growth effect of monetary policy in these oil-based economies; in particular, the role of monetary policy is constrained in the higher oil price regime with added liquidity in the economy. Therefore, the current research
adds to existing literature through the specification of the Bayesian panel VAR model whilst also specifying oil price as being amongst other variables in the transmission channel for the selected sample of Middle Eastern countries. Whereas we select US real interest rate as a stance measure of US monetary policy, earlier Olumuyiwa et al. (2019) analysed the effects of spillovers of US monetary policy on Gulf Cooperation Council (GCC) countries through its transmission in the regional output growth. However, the current research analyses the impact of the fluctuation in the US monetary policy on the regional monetary sector indicators, such as market interest rate and domestic banking sector liquidity whilst incorporating oil price volatility into the model specification. Additionally, this research adopts Bayesian panel vector autoregression to determine the spillover effects whilst considering oil prices through a panel regression approach.

The current research finds that a positive shock in the federal funds rate induces a short-term positive shock in the domestic interest rates of Middle Eastern economies, which confirms the presence of the monetary policy trilemma in the region. The estimated results also reveal the impact of oil price fluctuations on the monetary policy anchors of both US and Middle Eastern economies.

Middle Eastern countries are commonly known as oil-based economies since oil constitutes a major part of fiscal revenues and foreign exchange earnings. Oil contributes around 62% of total regional exports (World Bank, 2021), and the average contribution of oil revenues to GDP remained at 23% from 1970 until 2019 (World Bank, 2021). In this context, fiscal policy mainly depends on oil price dynamics. Higher oil price volatility complicates the role of monetary policy in these oil-based economies, as oil price-induced fluctuations mainly disturb the liquidity position of the regional banking sector. Higher oil prices cause large fiscal and trade surpluses and therefore increase liquidity, whereas lower oil prices reduce the liquidity
in the domestic banking system. Moreover, since the regional economies follow a US dollar-pegged exchange rate system, the said economies resort to aligning their monetary policy stance with the stance of US monetary policy. Consequently, domestic policy rates in these Middle Eastern economies follow the changes in federal funds rates in the US.

Mainly, a central bank manages the liquidity position in the banking system to align short-term interest rates with its policy rate; this kind of policy also constrains commercial banks’ actions, which may deviate from policy objectives, through limiting imbalances in the system. Nevertheless, commercial banks maintain a specific level of liquidity for payment and precautionary purposes, although this extra provision of liquidity may translate into a lower market interest rate with expanded credit. In contrast, a tight liquidity situation leads to higher lending rates, which may lead to a reduction in the credit expansion, having a potential negative impact on economic growth. Henceforth, oil price-led liquidity changes can obstruct monetary policy implantation and can lead to an undesired divergence between lending rates and policy rates. For example, a surge in liquidity because of higher oil prices enables banks to supply more loanable funds through the interbank market and this, in turn, lowers the cost of funding for banks, causing lower lending rates for borrowers. These oil price-led liquidity swings have constrained the pass-through of policy rates to short-term interbank lending rates in some Middle Eastern countries (IMF, 2017). In the case of low oil prices, and consequently lower liquidity, interbank rates may increase more than policy rates and banks will charge higher lending rates, thus reducing demand for loans as well as economic growth. Nevertheless, monetary authorities in the region conduct open market operations and use other standing facilities to manage short-term liquidity requirements, whereas structural liquidity conditions are administered through long-term government bonds, liquidity, reserve requirements and macroprudential instruments (Parsad and Khmis, 2011). However, these operations have
limited impact on domestic interest rates, due to the openness of the capital accounts of the economies in the region; additionally, indigenous interest rates swiftly follow the patterns of US nominal interest rates. Moreover, in these economies, monetary policy stance is represented through interbank rates as central banks mostly rely on direct instruments to implement monetary policy. However, with regard to fluctuations in interbank rates, it is difficult to determine whether they are caused by policy interventions or instigated by market dynamics (Bova, 2012). In Middle Eastern countries, as their currencies are pegged to the US dollar, this restricts the autonomy of their monetary policy and hence these economies rely on prudential regulations, fiscal policy, and other types of policy options to generate a balance between economic growth and price stability. However, this US dollar-pegged exchange rate policy has enabled regional economies to keep inflationary expectations at lower levels.

Henceforth, the current research aims to evaluate the autonomy of regional monetary policy through the examination of co-movements between the interbank interest rates of Middle Eastern economies and the federal funds rate. In addition, this research assesses the framework of the domestic banking sector and examines the degree of pass-through from policy rates to domestic lending and deposit rates. In this context, to determine the interest rates pass-through from US to Middle Eastern interest rates, the current research considers domestic banks’ rates over a period of three months for each country in the sample. Furthermore, empirical research suggests that the federal funds rate is a better indicator of monetary policy stance (Goodfriend, 1993; Bernanke and Blinder, 1992; Laurent, 1988; McCallum, 1983). The rest of this paper is structured as follows: Section 2 elaborates on the related literature, whilst Section 3 explains the data and methodology, following which Section 4 discusses the empirical results and, finally, Section 5 concludes and presents policy insights.
2. Literature Review

There exist many studies which have examined the transmission effects of the US monetary policy shocks on different economies whilst also considering the impact on domestic capital markets, output growth, and changes in the risk premium of domestic securities. However, there is a dearth of literature when it comes to investigating the Mundell-Fleming trilemma. This is due to the fact that, in the presence of easy international capital movements and a large volume of trade with a pegged exchange rate, it is difficult to ensure the autonomy of national monetary policy in oil-exporting countries. This trilemma is grounded on the classic assumption of a perfect capital market that has capital mobility, no arbitrage income, and global interest rate parity, all of which ensure the same bond yield across the world. In the case of fixed exchange rates and international mobility of capital, domestic monetary authorities maintain interest rates that can help to achieve the domestic macroeconomic targets of price stability and economic growth. However, according to the Mundell-Fleming approach, a flexible exchange rate reduces the inflow of speculative capital and provides more independence to the domestic central bank, allowing the said bank to employ an interest rate policy in order to achieve its macroeconomic objectives (Rey, 2015). Therefore, most of the earlier literature related to the Mundell-Fleming trilemma focuses on analysing the domestic interest rate behaviour of a country using the core country rate across exchange rate regimes. For instance, previous studies, e.g. Obstfeld et al. (2019), Klein and Shambaugh (2015), Goldberg (2013) and Obstfeld et al. (2005), suggest a weak correlation between short-term interest rates of domestic country and base country under a floating exchange rate as compared to a fixed exchange rate. Similarly, Kim (2001) evaluated the transmission of US monetary policy to G6 (non-US) countries and found a positive spillover effect on the output of those countries, which emerged through the world’s capital market. This was because monetary expansion in the US reduces the world’s real interest rate, which in turn enhances the world’s
aggregate demand for goods and services for both US and non-US countries (Svensson and Wijnbergen, 1989; Obstfeld and Rogoff, 1995). The interest rate channel of international transmission was further confirmed by Takáts and Vela (2014), who suggested that any change in the monetary policy of developed countries causes a subsequent change in the monetary policy of emerging market economies under a flexible exchange rate. Additionally, the transmission of monetary policy is also influenced by oil price shocks, since any change in oil price affects the domestic consumer price indices as well as the wage rates. In this case, monetary authorities need to adopt certain additional policy options to reduce inflation in the economy (Adjemian and Paries, 2008). An increase in oil price raises the domestic interest rate through inflation rate channels and a contractionary monetary policy is required to offset such an effect (Cologni and Manera, 2008). In this context, the current research aims to examine the transmission of US monetary policy to oil-exporting countries whilst incorporating the oil price channel under a time-varying vector autoregression specification. Earlier, Burakov (2017) investigated the Mundell-Fleming trilemma using the oil price channel for Russia (an oil-exporting country), whilst simultaneously considering the flexible exchange rate regime; the above-mentioned author also employed a linear specification of the vector error correction model. The research found little evidence of the Mundell-Fleming trilemma, as a positive shock in US federal funds rate led to lower oil prices, and that, in turn, increased the Russian policy rate. In contrast, Olumuyiwa et al. (2018) evaluated the spillover effects of US monetary policy on GCC countries’ monetary policy whilst using oil price as an additional factor. Their research employed panel vector autoregression (fixed effect) specification and found that oil prices can affect the liquidity position of the domestic banking sector in GCC countries and therefore can alter the impact of US monetary policy on the non-oil output of GCC economies. The current research differentiates itself from the aforementioned work, as it considers the spillover effects of the transmission of changes in the US monetary policy stance on the monetary policy stance
of dollar-pegged economies of the Middle Eastern region. Since the Mundell-Fleming trilemma suggests the interdependence of the monetary policy of fixed exchange rate regimes with free capital mobility, our research tests this hypothesis using the Bayesian panel vector autoregression model.

Bayesian methods are commonly employed as statistical tools for the probability-based quantification of uncertainty in inferences. Especially, the Bayesian vector autoregression (BVAR) approach is advantageous because of its flexibility and objectivity. The BVAR strategy is useful in resolving the issue of over-parametrisation of VAR and the non-stationarity of the data, thereby helping to attain more accurate forecasts (Banbura et al., 2010). The statistical problems such as unit root and random walk can be resolved using Litterman/Minnesota prior type (Litterman, 1980, 1986; Doan et al., 1984; Sims, 1992; Sims and Zha, 1998). A BVAR mode allows flexibility, making it possible to include many variables without imposing any restrictions whilst simultaneously taking care of spurious correlations, which leads to better forecasting performance.

Since oil prices and the monetary environment are both characterised by volatility and uncertainty, the current research employs a Bayesian panel VAR specification. Following Gelman et al. (2007), this research employs the hierarchical prior which considers the common mean and covariance of VAR coefficients as random variables with some prior distribution. Over the years, empirical research has diverted its focus to Bayesian panel vector autoregression methods, such as Ballabriga et al. (1999) employed this approach to examine the transmission shocks in macroeconomics, whilst Gerlach and Smets (1996) analysed the propagation effects of monetary policy in the European area. Conversely, some researchers, including Hoffmaister and Roldos (1997) and Rebucci (1998), utilised the Bayesian panel approach to evaluate the average differential response of underdeveloped and developed countries to domestic and external shocks. Despite the rising interest in the panel BVAR, the
literature is still limited. Canova and Ciccarelli (2003) used a flexible panel Bayesian VAR model to identify the turning points. This model captures the time variation in the parameters and interdependencies in the cross-section with a posterior distribution obtained through hierarchical and for Minnesota-type priors. Wieladek (2016) employed a varying coefficient Bayesian panel VAR specification to analyse the impact of commodity price shocks on key macroeconomic variables for selected OECD countries. Similarly, Christou et al. (2017) analysed the impact of economic policy uncertainty (EPU) on the returns of the stock markets of a panel of six countries whilst using a Bayesian panel VAR model through the process of stochastic search specification selection (SSSS). In contrast, Urbina and Rodriguez (2020) examined the impact of corruption on economic growth and human development whilst using the Bayesian panel vector autoregression specification with hierarchical prior, proposed by Gelman et al. (2003).

3. Data and Methodology

3.1 Data Description

To evaluate the causal effects of the US monetary policy stance on the monetary policy of Middle Eastern economies, the present research considers four variables of the Bayesian panel vector autoregression model, namely: a measure of the stance of US monetary policy such as federal funds rate, the domestic interest rate of each selected Middle Eastern country, the domestic liquidity for each Middle Eastern country, and global crude oil prices.

The current research selects five regional countries – Saudi Arabia, the United Arab Emirates, Qatar, Oman and Kuwait – whilst considering the monthly data for the sample period spanning 2009m10 until 2021m12. All variables are seasonally adjusted and data for each variable is extracted from the database of international financial statistics (IFS).
3.2 Empirical Methodology

To examine the international transmission of US monetary policy to the fixed exchange rate
regimes of the Middle East, the current research employs a Bayesian panel vector
autoregression (PVAR) model. This approach considers both time variation and heterogeneity
in the cross-sectional dimensions. A Bayesian PVAR specification draws the inferences whilst
assuming that all covariates in the system are endogenous. Given that our research includes a
relatively small samples panel, we employ Bayesian PVAR to resolve the over-
parameterisation issue.

Generally speaking, a panel VAR model entails $N$ “units” that may indicate countries, firms,
industries or economic sectors. Each unit contains $n$ endogenous variables, as well as $T$ periods
with $p$ lags. The current project employs a balanced panel which implies that the number of
variables is the same across units, with a similar sample period and common exogenous
variables.

Usually, we specify a panel VAR for unit $i$ (with $i = 1, 2, \ldots, N$) as follows:

---

**Table 1. Description of the Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Funds Rate</td>
<td>The federal funds rate is the main interest rate in the US monetary system and its target rate is decided by the Federal Open Market Committee (FOMC). This rate is used for interbank lending and borrowing for short-term transactions. Source: International Financial Statistics – 2021</td>
</tr>
<tr>
<td>Domestic Interest Rate</td>
<td>Three months’ domestic bank rate for each country in the sample. Source: International Financial Statistics – 2021</td>
</tr>
<tr>
<td>Domestic Liquidity</td>
<td>Domestic liquidity is measured by the broader monetary aggregate – M2 – for each country in the sample. Source: International Financial Statistics – 2021</td>
</tr>
<tr>
<td>Oil Prices</td>
<td>Brent crude oil price (annual average). Source: International Energy Agency – 2021</td>
</tr>
</tbody>
</table>

---
\[
y_{i,t} = \sum_{j=1}^{N} \sum_{k=1}^{P} A_{ij,t}^{k} y_{j,t-k} + C_{i,t} x_{t} + \epsilon_{i,t} \\
= A_{i1,t} y_{1,t-k} + \cdots + A_{ip,t} y_{p,t-k} + A_{i1,t} y_{2,t-p} + A_{i2,t} y_{2,t-p} + \cdots + A_{iN,t} y_{N,t-p} + C_{i,t} x_{t} + \epsilon_{i,t}
\]

Equation (i)

where \( y_{i,t} \) shows an \( n \times 1 \) vector of \( n \) endogenous variables of unit \( i \) at time \( t \) and \( y_{i,j,t} \) is the \( j \)th endogenous variable of unit \( i \), whereas \( A_{ij,t}^{k} \) is an \( n \times n \) matrix of coefficients that indicate the response of unit \( i \) to the \( k \)th lag of unit \( j \) at period \( t \), whilst \( x_{t} \) is the \( m \times 1 \) vector of exogenous variables and \( C_{i,t} \) is the \( n \times m \) matrix relating the endogenous variables to these exogenous variables. Finally, \( \epsilon_{i,t} \) is a \( n \times 1 \) vector of residuals for the variables of unit \( i \), with the following properties: \( \epsilon_{i,t} \sim N(0, \Sigma_{i,t}) \). Moreover, the period-specific variance-covariance matrix indicates a general form of heteroskedasticity.

We estimate a total of \( k = Nnp + m \) coefficients in the dynamic equation at period \( t \) for each variable in unit \( i \), which implies that we estimate \( q = n(Np+m) \) coefficients for the whole unit.

Stacking over the \( N \) units, we can write Equation (i) as:

\[
y_{t} = \sum_{k=1}^{P} A_{t}^{k} y_{t-k} + C_{t} x_{t} + \epsilon_{t} \\
= A_{t}^{1} y_{t-1} + \cdots + A_{t}^{p} y_{t-p} + C_{i,t} x_{t} + \epsilon_{i,t}
\]

Equation (ii)

Equation (ii) represents the most general form of the panel VAR specification and contains \( h = Nq = Nn(Np + m) \) coefficients to estimate, whilst the vector of residuals \( \epsilon_{t} \) is characterised as: \( \epsilon_{t} \sim N(0, \Sigma_{t}) \). However, this general type of representation is complex in nature when it comes to generating accurate estimates, whilst it also consumes more degrees of freedom. Therefore, if the sample units are homogenous in their characteristics and are expected to have
symmetrical responses to structural economic shocks, then we can relax certain assumptions, such as cross-sub-sectional heterogeneity.

Under the Bayesian VAR specification, model parameters are considered random variables with some probability distribution (Litterman, 1979; Doan et al., 1984). This approach includes certain prior information about the model parameters and updates the probability distributions conditional on the observed data. Since our research aims to investigate the average response of Middle Eastern monetary policy to a shock in US monetary policy and our panel units are mainly homogenous in their characteristics, we thus employ the Bayesian panel VAR pooled estimator, indicating homogenous coefficients across the selected countries. In this case, we relax the properties of the general form of the panel VAR, such as dynamic interdependencies ($A_{ij,t}^k \neq 0$ when $i \neq j$), static interdependencies ($\Sigma_{i,j,t} \neq 0$ when $i \neq j$), cross sub-sectional heterogeneity ($A_{ij,k,t}^i \neq A_{ij,k,t}^j$, $C_{i,t} \neq C_{j,t}$ and $\Sigma_{ii,t} \neq \Sigma_{jj,t}$ when $i \neq j$) and dynamic heterogeneity ($A_{ij,t}^k \neq A_{ij,s}^k$ when $t \neq s$).

To estimate our Bayesian panel VAR, we employ the standard normal-Wishart prior with default hyperparameter values. Generally, the normal-Wishart prior is preferred over the Minnesota (Litterman) prior, as it is based on the assumption that our panel VAR estimates and residual covariance matrix are unknown, whereas the latter approach assumes that the residual covariance matrix is known.

4. Estimation and Results

To conduct the empirical analysis, we first employ Pesaran’s (2007) cross-sectionally augmented IPS (CIPS) panel unit root test to examine the unit root properties and the order of integration for the selected data series (Table 2). These test statistics include both a constant and a trend. The estimates of the CIPS statistics indicate that some of the series are stationary.
at level, but all the selected series are stationary at first difference (Table 2). However, under the Bayesian framework, non-stationarity is not a concern, as the properties of posterior distribution remain the same for both stationary and non-stationary models.

Table 2. Pesaran’s (2007) Cross-sectionally Augmented IPS (CIPS)

<table>
<thead>
<tr>
<th></th>
<th>Level</th>
<th>First Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFR</td>
<td>CIPS -stat</td>
<td>-0.38399</td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.0435</td>
</tr>
<tr>
<td>DR</td>
<td>CIPS -stat</td>
<td>2.47935</td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.9934</td>
</tr>
<tr>
<td>LIQ</td>
<td>CIPS -stat</td>
<td>-10.0345</td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.000</td>
</tr>
<tr>
<td>OIL</td>
<td>CIPS -stat</td>
<td>0.34857</td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.6342</td>
</tr>
</tbody>
</table>

4.1 Bayesian Panel Multivariate Impulse Response Analysis

This section presents the impulse responses of the selected variables generated through the estimation of the time-varying coefficient Bayesian panel VAR model. It examines the presence of the monetary policy trilemma for Middle Eastern countries and focuses on how changes in the US monetary policy anchor – namely the federal funds rate – affect the domestic interest rates in the Middle Eastern countries. To recover the structural shocks through Cholesky factorisation, we place the fast-moving variables last, whereas slow-moving variables are arranged first, i.e., \( X_{it} = [FFR, OIL, LIQ, DR] \). Under this specification, domestic interest rate (DR) and banking sector liquidity (LIQ) are the most endogenous variables in the system, and any change in the US monetary policy (FFR) affects the Middle Eastern interest rates (DR) via a time lag.

Figure 1 presents the estimated impulse response functions for each variable. The first row shows the response of DR to one standard deviation shock in the other variables, which include the federal funds rate (FFR), oil price (OIL), and domestic banking sector liquidity (LIQ). The
current research considers the average response during the first three months as the short run and average response for 12 months and 13-30 months as medium and long term respectively. Figure 1 illustrates that a one standard deviation shock in FFR reduces the domestic interest rate by 0.6% in the first quarter, and in the long run a similar shock in FFR induces a positive trend in the DR, though it remains in the negative range. This trend can be rationalised, as a higher US interest rate will make Middle Eastern exports more competitive, and a consequent increase in liquidity will reduce the interest rate in the Middle Eastern region. However, this trend only lasts for a short period, as oil, being a supply-side input in the US market, faces a lower US demand induced by lower economic activity caused by a higher interest rate. This argument can be further supported by the evidence found below, as changes in the US interest rate (FFR) reduce the oil price for a short duration (Figure 1). Similarly, one standard deviation shock in the global oil price reduces the Middle Eastern DR due to large availability of liquidity in the region. Furthermore, a positive shock in liquidity reduces the DR in the short run, although in the long run the average response of the DR to a liquidity shock becomes positive. However, a one standard deviation shock in FFR reduces the global oil price in the short run, and it remains negative over the long term to a similar type of shock in FFR.

Figure 1. Bayesian Panel Multivariate Impulse Response Functions

(Note: Shaded area represents 95% credibility intervals for the normal-Wishart prior)
The estimates of impulse response functions are further augmented by the analysis of historical decomposition in Figure 2, which reveals that around 20% of variation in the DR is caused by FFR over the sample period (Figure 2). Conversely, global oil prices account for around 35% of the total variation in the DR of Middle Eastern countries. Additionally, oil prices make up around 30% of the total variation in FFR, which can be characterised as the supply-side transmission mechanism of oil price fluctuations to US monetary policy. Figure 2 also reflects a smaller percentage contribution of Middle Eastern interest rate fluctuation to US monetary policy, as the US is the major trade partner of this region.

**Figure 2. Historical Decomposition**

4.2 Robustness Checks

To ensure the robustness of our estimates, we also apply some additional empirical techniques, such as a homogenous panel VAR through the GMM estimator. Since our model contains only a few variables, the GMM approach is capable of obtaining robust results without any additional restrictions. Figure 3 presents the orthogonalised impulse response functions (IRFs), which are based on Cholesky factorisation and generated through the estimation of GMM-based panel vector autoregression with 95% confidence intervals. The ordering for Cholesky decomposition follows the endogeneity criteria, which implies that those variables which are ordered first affect the other variables with a time lag. In this case, $X_{i,t} = [OILPR, FFR, LIQ, DR]'$, and it indicates that the DR is the most endogenous variable in the system. The first row in Figure 3 illustrates shocks in specific variables; for example, a shock in the DR has a significant impact on oil price. Overall, these GMM-based IRFs reveal results
identical to those achieved with Bayesian panel VAR. The figure below also shows that a one standard deviation shock in FFR has a negative and statistically significant impact on oil price, indicating that tight US monetary policy raises the cost of production and consequently demand for oil decreases. However, this relationship is positive and statistically significant for the oil-exporting countries, as a tight domestic monetary policy leads to less oil production, giving rise to a hike in oil production.

**Figure 3. GMM PVAR-based Impulse Response Functions**

To augment our findings from the impulse response function analysis, the current research further employs the Granger causality tests to determine the causal relationships between the selected variables. In this context, we first use the homogenous GMM PVAR model to conduct the Granger causality test introduced by Abrigo and Love (2016). Table 3 presents the estimates, and this test is based on the null hypothesis that variable X (Row variable) does not Granger-cause variable Y (Column variable). The estimates reveal that the DR does Granger-cause liquidity in the domestic banking sector and oil price changes. In addition, Table 3 shows that the US FFR causes a change in the DR in the Middle Eastern region. The table also reveals that the US FFR has a causal relationship with oil price. Furthermore, the test estimates reveal
the causal relationship between domestic banking sector liquidity and DR. Finally, Table 3 also presents the causal linkages between the DR and oil price, as well as between US FFR and domestic banking sector liquidity. Additionally, we further confirm this causality through another Granger causality test introduced by Dumistrescu and Hurlin (2012) for heterogeneous panels (Table 4). This test calculates individual Wald statistics for each cross-section unit and then averages them for all cross-section units to test for Granger non-causality. This test is advantageous, as it can handle a small sample size in terms of time and cross-section units. These test estimates confirm the same type of causal relationships suggested by the Granger causality test based on the approach forwarded by Abrigo and Love (2016).

Table 3: Granger Causality Test Results – Abrigo and Love (2016) Approach

<table>
<thead>
<tr>
<th>Y→</th>
<th>X→</th>
<th>DR</th>
<th>FFR</th>
<th>LIQ</th>
<th>OILPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DR</td>
<td>χ²</td>
<td>3.251</td>
<td>4.864</td>
<td>3.387</td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.025**</td>
<td>0.003***</td>
<td>0.042**</td>
<td></td>
</tr>
<tr>
<td>FFR</td>
<td>χ²</td>
<td>1.832</td>
<td>1.912</td>
<td>-3.392</td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.350</td>
<td>0.148</td>
<td>0.038</td>
<td></td>
</tr>
<tr>
<td>LIQ</td>
<td>χ²</td>
<td>7.435</td>
<td>0.034</td>
<td>4.492</td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.00</td>
<td>0.563</td>
<td>0.008</td>
<td></td>
</tr>
<tr>
<td>OILPR</td>
<td>χ²</td>
<td>-4.568**</td>
<td>0.856</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.0245</td>
<td>0.447</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: ***, **, and * represent the significance levels at 1%, 5% and 10% respectively.

Table 4: Granger causality test results – Dumistrescu and Hurlin (2012) Approach

<table>
<thead>
<tr>
<th>Y→</th>
<th>X→</th>
<th>DR</th>
<th>FFR</th>
<th>LIQ</th>
<th>OILPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DR</td>
<td>Z</td>
<td>2.918</td>
<td>3.521</td>
<td>5.782</td>
<td></td>
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<tr>
<td></td>
<td>p-value</td>
<td>0.052**</td>
<td>0.002**</td>
<td>0.000***</td>
<td></td>
</tr>
<tr>
<td>FFR</td>
<td>Z</td>
<td>1.531</td>
<td>0.642</td>
<td>-3.495</td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.456</td>
<td>0.215</td>
<td>0.051**</td>
<td></td>
</tr>
<tr>
<td>LIQ</td>
<td>Z</td>
<td>5.324***</td>
<td>0.436</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.00</td>
<td>0.502</td>
<td>0.341</td>
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</tr>
<tr>
<td>OILPR</td>
<td>Z</td>
<td>-4.671</td>
<td>5.612</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.431</td>
<td>0.0281**</td>
<td>0.000***</td>
<td></td>
</tr>
</tbody>
</table>

Note: ***, **, and * represent the significance levels at 1%, 5% and 10% respectively.
Overall, our results reveal that domestic interest rates in Middle Eastern countries are influenced by the changes in the stance of monetary policy – the FFR. This, in turn, indicates the presence of the Mundell-Fleming trilemma, which implies that monetary policies in the US dollar-based fixed exchange rate regimes are persuaded by the fluctuations in the US monetary policy. The current research also finds that the US monetary policy stance is also influenced by the changes in global oil prices, indicating that higher oil prices lead to lower economic activity and, consequently, the US follows the expansionary monetary policy. Similarly, an increase in the US interest rate leads to lower domestic demand for oil in the US, and this follows a drop in global oil prices. Moreover, our estimates reveal that an increase in global oil prices enhances the domestic liquidity in Middle Eastern countries, and subsequently leads to lower domestic interest rates.

5. Conclusion

Middle Eastern economies are characterised as dollar-pegged exchange rate economies and monetary policy in the region is influenced by the changes in US monetary policy stance. Therefore, this research aims to evaluate the existence of the monetary policy trilemma in the region whilst selecting a panel of five Middle Eastern countries under a non-linear specification of Bayesian panel vector autoregression. The sample of selected countries includes Saudi Arabia, the United Arab Emirates, Oman, Qatar, and Kuwait. This research considers a vector of four variables, namely domestic interest rate, a measure of domestic liquidity such as M2, oil prices, and FFR, covering the monthly data for the period 2009m10 until 2021m12. To examine the unit root properties and order of integration for the selected variables, the current research employs Pesaran’s (2007) cross-sectionally augmented IPS (CIPS) panel unit root test, and the estimates reveal that some of the variables are not stationary at level. However, under the Bayesian framework, non-stationarity is not a concern, due to specific characteristics of
posterior distribution. The IRFs generated through the estimation of the time-varying coefficient Bayesian panel VAR model suggest that a one standard deviation shock in US FFR increases the discount rate in the long run, due to its impact on capital mobility and consequent appreciation of the dollar. In addition, a positive shock in US FFR reduces global oil prices, as contractionary monetary policy induces a reduction in economic activity. Furthermore, a positive shock in terms of oil price reduces the domestic interest rates in Middle Eastern countries. These findings are also validated through alternative GMM specifications. Henceforth, this research provides evidence of a relatively weaker form of the monetary policy trilemma and suggests that regional central banks should account for this phenomenon whilst formulating monetary policy for their countries.

References


World Bank, 2021, World Bank Database

Wieladek, T. (2016). The varying coefficient Bayesian panel VAR model