Topics in Middle Eastern and African Economies

Proceedings of Middle East Economic Association

Vol. 25, Issue No. 1, May 2023

Regime-Dependent Financial Risk Transmission and Connectedness in MENA Economies: A Smooth Transition Threshold Vector Autoregressive Analysis

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Abstract

This study examines the impact of global financial market conditions on risk connectedness and transmission among MENA economies. Using weekly stock market volatilities and a smooth transition threshold vector autoregressive model, the authors analyze risk transmission under varying financial stress levels. Results show stronger risk interdependency during high-stress periods, with Kuwait, Oman, Qatar, Saudi Arabia, Turkey, and the UAE as net risk transmitters. The regime-dependent model reveals stronger risk transmission compared to the overall mean-based VAR model.

1. Introduction

External macroeconomic shocks, stemming from financial, geopolitical, economic, and environmental uncertainties, are often perceived as threats to domestic economic prospects, particularly in emerging and developing nations with vulnerable economic indicators. These external economic shocks may lead to increased credit costs, affecting the decision-making processes of major economic agents, such as households, firms, and governments. Although a considerable body of literature has illustrated that uncertainty shocks disseminate to various economic sectors predominantly via financial markets, the degree of financial risk transmission consequences arising from external macroeconomic conditions remains largely unexplored (Balcilar et al. 2022). In this concise paper, we conduct an empirical investigation into the impact of aggregated external macroeconomic shocks on the financial connectedness and risk transmission across Middle East and North Africa (MENA) countries under distinct financial contexts — low and high financial stress regimes.

The remaining part of the paper is organized as follows: Section 2 presents the methodology. The findings are presented in Section 3 while section 4 concludes the paper.

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2. Methodology

To accomplish our goal, we utilize two separate datasets: stock market data and macroeconomic conditions variables data from January 1, 2005, to November 27, 2022, for MENA countries (refer to Table 1 for variables and sources). We investigate numerous potential determinants of financial risk connectedness, including aggregate external macroeconomic conditions variables. In this process, we employ the U.S. financial condition index (FCI) as an indicator of global financial conditions, as the U.S. economy is not only the largest but also a primary influencer of worldwide financial conditions (see Jordà et al., 2013; Chen et al., 2016; Balcilar & Demirer, 2022). Moreover, to thoroughly assess risk, we compute weekly realized stock market volatilities using daily data from June 4, 2018, to April 1, 2021, for the 11 MENA countries included in this study. These volatilities are primarily market-based measurements. We propose a hypothesis that financial risk connectedness among MENA countries fluctuates with global financial conditions. This hypothesis is tested using the smooth transition vector autoregressive (STVAR) model within the framework of the Diebold-Yilmaz connectedness index, as proposed by Diebold and Yilmaz (2009; 2012).[2] This model allows a specification mechanism where the financial condition index (FCI) variable governs the regime-switching. In addition, estimates of the effects of global macroeconomic factors on regime probabilities are considered with the probability of the financial stress regime estimated by $F_t = F(z_{t-d}; \hat{\gamma}, \hat{c})$ at the values of the transition variable, $z_{t-d} = FCI_t$ given the estimates of parameters $\hat{\gamma} = 5.870$ and $\hat{c} = -0.059$. The results of the intercept and slope match with the ordinary least squares (OLS) regression model.

3. Findings

The regime-dependent connectedness analysis of financial risks is based on weekly realized stock market volatilities. The overall financial risk connectedness differs significantly between low and high financial stress regimes. As shown in Table 2, our findings indicate that during low financial stress periods, the total financial risk connectedness among MENA countries is 52.79%, while during high financial stress periods, it increases to 72.94%. This implies that financial risk connectedness is more pronounced during high financial stress regimes compared to low financial stress periods. Examining country-specific transmission

[2] We extend the spillover index model of Diebold and Yilmaz (2009; 2012) to a nonlinear setting through the STVAR model to capture regime-dependent financial risk connectedness.

reveals that oil-rich countries, such as the United Arab Emirates, Saudi Arabia, Qatar, Kuwait, and Oman, contribute substantially to the forecast error variance decomposition (FEVD) of other countries in the region. In contrast, countries with limited or no oil resources, such as Bahrain, Jordan, Morocco, Tunisia, and Turkey, receive the largest share of financial risk connectedness from the FEVD of other regional countries. As a result, the net connectedness of the top three financial risk transmitters (United Arab Emirates, Saudi Arabia, and Qatar) is positive during the low financial stress regime. Similarly, during the high financial stress regime, other oil-endowed countries in the region, including Oman, Kuwait, and Turkey, exhibit positive net connectedness, in addition to the United Arab Emirates, Saudi Arabia, and Qatar. Turkey's inclusion can be attributed to its larger economy and higher level of industrialization compared to other countries in our sample.

This analysis reveals that countries with positive net connectedness transmit more financial risks to the forecast error variance decomposition (FEVD) of other countries than they receive from them. On the other hand, countries with negative net connectedness receive more financial risk connectedness than they transmit to the FEVD of other countries. Moreover, the findings presented in Table 3 demonstrate that external macroeconomic conditions significantly contribute to financial risk connectedness among MENA countries. Although the impacts of most macroeconomic condition variables are positive, the effects of the news sentiment index, Gold, and SP500 on regime probabilities are negative.

Conclusion

Based on the empirical findings presented in this brief paper, the key takeaways are as follows: firstly, the spillover dynamics of financial risk among MENA countries have been uncovered. Secondly, although the degree of financial risk connectedness varies between low and high financial stress regimes, a more pronounced risk connectedness is observed during periods of high financial stress. Lastly, while oil-rich countries predominantly transmit risk connectedness to others more than they receive, countries with limited or no oil resources tend to receive risk connectedness more than they transmit within the region. These insights, considering the ever-changing market conditions, may offer valuable information for policy formulation, risk management, and asset allocation decision-making.

Table 1. Variable description

Variable Name	Definition	Source	KAOPEN	KAOPEN Class	Region
BH	Realized volatility of broad stock market index for Bahrain	Refinitiv Eikon	0.99	High	Middle East
EG	Realized volatility of broad stock market index for Egypt	Refinitiv Eikon	0.58	Medium	North Africa
JO	Realized volatility of broad stock market index for Jordan	Refinitiv Eikon	1.00	High	Middle East
KW	Realized volatility of broad stock market index for Kuwait	Refinitiv Eikon	0.70	High	Middle East
MA	Realized volatility of broad stock market index for Morocco	Refinitiv Eikon	0.16	Low	North Africa
OM	Realized volatility of broad stock market index for Oman	Refinitiv Eikon	1.00	High	Middle East
QA	Realized volatility of broad stock market index for Qatar	Refinitiv Eikon	1.00	High	Middle East
SA	Realized volatility of broad stock market index for Saudi Arabia	Refinitiv Eikon	0.70	Medium	Middle East
TN	Realized volatility of broad stock market index for Tunisia	Refinitiv Eikon	0.16	Low	North Africa
TR	Realized volatility of broad stock market index for Turkey	Refinitiv Eikon	0.37	Low	Middle East
AE	Realized volatility of broad stock market index for United Arab Emirates	Refinitiv Eikon	1.00	High	Middle East
BRENT	Brent Europe crude oil price in US dollars per Barrel	U.S. Energy Information Administration			
VIX	Chicago Board Options Exchange, CBOE Volatility Index	Chicago Board Options Exchange			
GOLD	Gold Price in US dollars per Troy Ounce	Refinitiv Eikon			
SP500	The Standard and Poor's 500 stock market index	S&P Dow Jones Indices			
NWS	News sentiment index	Federal Reserve Bank of San Francisco			
UNC	US economic policy uncertainty	Baker et al. (2016)			
IDV	Infectious disease equity market volatility	Baker et al. (2019)			
FSIWRD	OFR world financial stress index	Office of Financial Research			
FSIADV	OFR advanced economies financial stress index	Office of Financial Research			
FSIUS	OFR US financial stress index	Office of Financial Research			
FSIEMR	OFR emerging markets financial stress index	Office of Financial Research			
VOLWRD	OFR world financial stress index	Office of Financial Research			
FCI	Chicago Fed National Financial Conditions Index	Federal Reserve Bank of Chicago			

Note: Realized stock market volatilities are calculated by the authors bases on stock market indices sourced from Refinitiv Eikon. KAOPEN is the Chinn-Ito index of capital account openness (Chinn and Ito, 2006). In addition to eleven MENA nation stock market volatility factors, the dataset contains the following global macroeconomic variables: Standard and Poor's 500 stock market index (SP500), Brent crude oil price (BRENT), gold price (GOLD), news sentiment index (NWS) of the Federal Reserve Bank of San Francisco (sourced from https://www.frbsf.org/economic-research/indicators-data/daily-news-sentiment-index/), US economic policy uncertainty index (UNC) of Baker et al. (2016) (sourced from http://policyuncertainty.com/us_monthly.html), infectious disease equity market volatility (IDV) of Baker et al. (2019) (sourced from http://policyuncertainty.com/infectious_EMV.html), Chicago Board Options Exchange (CBOE) volatility index (VIX) (sourced from https://www.cboe.com/tradable_products/vix/vix_historical_data/). Office of Financial Research (OFR) of the US Department of the Treasury global financial stress variables include: the OFR world financial stress index (FSIWRD), the OFR advanced economies financial stress index (FSIADV), the OFR US financial stress index (FSIUS), the OFR emerging markets financial stress index (FSIEMR), and the OFR world volatility index (VOLWRD) (all retrieved from https://www.financialresearch.gov/financial-stress-index/. The Federal Reserve Bank of Chicago provides the national financial condition index (FCI) for the United States (https://www.chicagofed.org/research/data/nfci/current-data).

Table 2. Regime dependent connectedness -

Low financial stress regime												
	BH	EG	JO	KW	MA	OM	QA	SA	TN	TR	AE	From
BH	29.30	6.75	0.81	10.62	1.71	4.09	17.33	12.50	0.34	2.60	13.95	70.70
EG	0.08	49.95	1.89	1.59	0.81	3.96	10.48	7.55	0.01	1.66	22.01	50.05
JO	0.20	1.65	56.98	1.07	0.29	1.78	11.00	10.90	0.03	0.77	15.32	43.02
KW	1.20	5.16	0.74	21.79	1.56	7.33	13.78	15.38	0.13	1.45	31.49	78.21
MA	0.74	8.54	1.75	1.03	60.90	0.77	2.56	4.80	0.11	2.61	16.18	39.10
OM	0.29	2.65	1.50	3.74	0.23	30.75	10.91	21.38	0.04	1.31	27.19	69.25
QA	0.21	2.30	1.21	2.20	0.24	4.00	51.33	13.12	0.05	0.87	24.46	48.67
SA	0.16	3.96	0.97	3.03	1.12	4.63	11.07	54.50	0.06	2.40	18.10	45.50
TN	0.10	0.69	5.78	5.35	5.96	4.40	2.61	18.11	41.88	1.12	14.00	58.12
TR	0.09	5.51	2.54	1.29	1.16	1.92	4.75	6.42	0.02	63.54	12.75	36.46
AE	0.28	2.92	1.72	3.19	0.83	4.82	9.08	17.68	0.03	1.07	58.39	41.61
To	3.36	40.13	18.91	33.13	13.91	37.69	93.57	127.84	0.84	15.87	195.44	**52.79**
Net	-67.34	-9.92	-24.11	-45.09	-25.19	-31.56	44.90	82.34	-57.27	-20.59	153.83	
High financial stress regime												
	BH	EG	JO	KW	MA	OM	QA	SA	TN	TR	AE	From
BH	6.54	0.47	0.38	31.09	2.91	18.04	9.43	16.36	0.16	4.83	9.79	93.46
EG	0.45	28.29	5.82	19.39	2.70	15.68	8.15	4.66	0.13	8.88	5.86	71.71
JO	0.32	1.59	29.14	5.40	6.39	10.75	5.67	9.14	0.08	9.34	22.18	70.86
KW	1.52	1.89	1.31	50.91	0.69	4.38	8.49	11.59	0.03	8.87	10.33	49.09
MA	0.67	4.88	5.14	2.91	17.58	4.34	14.34	14.18	0.12	10.64	25.20	82.42
OM	1.00	6.41	1.11	7.25	1.93	25.84	10.05	14.38	0.03	15.23	16.78	74.16
QA	0.82	9.00	5.45	2.10	0.34	4.08	33.91	16.24	0.08	11.13	16.86	66.09
SA	1.63	3.11	5.12	3.83	1.32	4.89	8.52	40.60	0.01	19.41	11.58	59.40
TN	0.74	2.14	1.44	24.26	2.82	21.23	26.68	5.62	1.56	1.74	11.77	98.44
TR	0.38	1.50	6.95	5.61	2.30	8.76	10.31	14.62	0.16	30.42	19.00	69.58
AE	1.56	7.80	8.48	1.92	0.60	4.30	8.29	19.22	0.05	14.95	32.83	67.17
To	9.07	38.80	41.19	103.75	21.99	96.46	109.92	126.01	0.84	105.00	149.34	**72.94**
Net	-84.39	-32.91	-29.67	54.66	-60.43	22.29	43.83	66.62	-97.60	35.42	82.17	

Note: The table displays regime-dependent connectedness measures computed in a manner similar to Diebold and Yilmaz (2012). In a linear VAR model, the lag order of the STVAR models is 1, as determined by the Bayesian information criterion (BIC). The threshold variable is the US financial conditions index (FCI) with a delay of zero. The estimates for STVAR smoothness and threshold parameter are 5.870 and -0.059, respectively. Low financial stress refers to regime periods with FCI less than the estimated threshold of -0.059, while high financial stress regime refers to regime periods that have FCI greater than the threshold of. The overall spillover index is shown in boldface.

Table 3: Estimates of the effects global macroeconomic factors on regime probabilities

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Intercept	0.0830* (0.0387)	-0.2868*** (0.0244)	0.3782*** (0.0409)	0.4250*** (0.0279)	0.1623*** (0.0082)	0.0302 (0.0173)	0.1790*** (0.0124)	0.1991*** (0.0069)	0.1963*** (0.0069)	0.2001*** (0.0068)	0.1986*** (0.0091)	0.2499*** (0.0097)
BRENT	0.0013** (0.0005)											
VIX		0.0241*** (0.0014)										
GOLD			-0.0002*** (0.00001)									
SP500				-0.0001*** (0.00001)								
NWS					-0.9857*** (0.0533)							
UNC						0.0013*** (0.0001)						
IDV							0.0007*** (0.0020)					
FSIWRD								0.0592*** (0.0029)				
FSIADV									0.1174*** (0.0051)			
FSIUS										0.1433*** (0.0078)		
FSIEMR											0.4177** (0.0172)	
VOLWRD												0.1523** (0.0067)
R^2	0.010	0.417	0.036	0.122	0.347	0.084	0.000	0.670	0.659	0.694	0.355	0.529

Note: The table reports regression estimates from a regression of the estimated probability of the high financial stress regime (F_t) on an external macroeconomic condition variable given in the first column of the table. The probability of high financial stress regime is estimated as $F_t = F(z_{t-d}; \hat{\gamma}, \hat{c})$ at the values of the transition variable $z_{t-d} = FCI_t$ given the estimates of parameters $\hat{\gamma} = 5.870$ and $\hat{c} = -0.059$. The intercept and slope estimates in the table correspond to the ordinary least squares (OLS) regression model $F_t = \beta_0 + \beta_1 X_t + e_t$, with X_t representing the external macroeconomic conditions variable and e_t is a white noise error term. Standard errors, given in brackets, are heteroskedasticity and autocorrelation robust. R^2 denotes the coefficient of determination. *** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05. See the note to Table 6 for the variable definition.

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