Online Annexes. Changing Tides: Spillovers from US Monetary Policy Normalization to the Middle East and Central Asia

Online Annex 2.1. Spillovers to Domestic Financial and Economic Conditions: A panel vector autoregression analysis

2.1.1. Methodology and Data

This annex analyzes the impact of an increase in US 10-year Treasury yields on ME&CA financial and economic variables using a panel vector autoregression (panel VAR). The dynamic relationship between the dependent variables ($Y_{i,t}$) and control variables (X_t) is modeled as follows:

$$Y_{i,t} = \sum_{l=1}^{L} A^l Y_{i,t-l} + \sum_{l=0}^{L} B^l X_{t-l} + \varepsilon_{i,t} \quad (1)$$

In the baseline specification, following IMF's 2014 Spillover Report (IMF, 2014), the dependent variables include stock market indices, nominal effective exchange rates (NEER), and long-term sovereign bond yields. Control variables in this specification include the US 10-year Treasury yield, the Chicago Board Options Exchange volatility index (VIX: as a measure of global uncertainty), and oil prices.[1] We estimate this model using quarterly data for 12 countries, seven of which are oil exporters (OEs: Bahrain, Kazakhstan, Kuwait, Oman, Qatar, Saudi Arabia, UAE) and five of which are oil importers (OIs: Egypt, Jordan, Morocco, Pakistan, Tunisia), covering the period 2018Q1-2021Q4. While the cross-sectional dimension of the panel is small, the country sample is representative of ME&CA. With a small size also along the time dimension, we report 6-month average responses, instead of average responses over a longer horizon. The time span is determined by the availability of yield data for ME&CA countries. Long-term sovereign bond yields in ME&CA are proxied by bonds ranging from 5- to 13-year maturity. The average time to maturity of sovereign bonds in the sample is less than 10 years.

2.1.2. Results

The panel VAR estimates (Table 2.1.1) suggest that in response to a 100-basis-point increase in the US 10-year Treasury yield, on average for ME&CA, stock prices fall by about 6 percent over a 6-month period following the initial shock, while exchange rates depreciate by about 3 percent. Additionally, long-term sovereign yields increase by about 56 basis points (bps). These results are consistent with the findings of IMF (2014) on spillovers from US monetary policy normalization to emerging market economies (EMs).

[1] This is similar to Adedeji et al. (2019) and Giovanni and Shambaugh (2008) who use foreign interest rates as exogenous variables. IMF (2014) decomposes the drivers of the US 10-year Treasury yield into money and real shocks.

In an alternative specification, we replace the stock price index with real GDP growth and include the CPI as a dependent variable. We find that a 100-bps increase in the US Treasury yield leads to a GDP contraction of about 13 bps over 6 months.[2]

To assess the impact of US monetary policy normalization on portfolio inflows in ME&CA, we specify a VAR model that includes a high-frequency measure of portfolio inflows (as a percentage of GDP), real GDP growth, and CPI-based inflation as dependent variables and the US 10-year Treasury yield, VIX and oil prices as exogenous variables.[3] The specification of this model (which excludes ME&CA sovereign yields given short-sample limitations), estimated at a quarterly frequency, has the advantage of exploiting all the information available on portfolio inflows (EPFR data), which goes back to the first quarter of 2000 for some countries in the sample. We find that, on average, a 100-bps rise in the US 10-year Treasury yield leads to an average decline in portfolio inflows of 0.28 percent of GDP over a 6-month period following the initial shock. In addition, we also find that portfolio inflows decline on average by 0.18 percent of GDP over a similar horizon following a one standard deviation increase in the VIX (which is equivalent to a 40 percent increase from its average value between 2000Q1 and 2021Q4) (Table 2.1.1).

Table 2.1.1. Average 6-month Response to a 100-bps Increase in US 10-year Treasury Yield and VIX

(In percent change, unless stated otherwise)	US 10-year Treasury yield	VIX
Equity	-6.1	
NEER	-3.1	
Real GDP growth	-0.13	
Sovereign yield (basis points)	55.9	
Portfolio inflows (in percent of GDP)	-0.28	-0.18

Source: IMF staff calculations.

Note: The responses are to a 100 basis points increase in the US 10-year Treasury yield and a 1 standard deviation increase in VIX.

2.1.3. The Role of Fundamentals

We explore the role of fundamentals in amplifying or reducing spillovers from US monetary policy normalization by interacting the US 10-year Treasury yield and VIX with various economic fundamentals. Therefore, X_t, in addition to containing the control variable of interest, also includes a variable that represents the interaction of the control variable with dummy variables capturing whether a country has strong or weak fundamentals. These dummy variables take on one when the value of the fundamental exceeds a certain threshold and zero otherwise. The fundamentals we consider are FX reserves in percent of GDP, public debt-to-GDP ratio, and the primary fiscal balance. In addition, we explore the role played by oil prices in mitigating spillovers to oil-exporting countries (Table 2.1.2). For GCC countries, reserve coverage is inclusive of sovereign wealth fund assets. The threshold for FX reserves is set at 50 percent of GDP, which corresponds to about 3 months of import coverage in our sample. The threshold

[2] This response is consistent with findings in recent studies using SVAR (Akinci and Queralto, 2021) and DSGE models (Ahmed et al., 2021).

[3] Portfolio inflows in this empirical exercise are fund flows collected from Emerging Portfolio Fund Research (EPFR) and aggregated at the quarterly frequency. We estimate that, on average, EPFR flows data represent 7.4 percent of total portfolio inflows in balance of payments data and follow similar dynamics. Therefore, we rescale EPFR flows by a factor of 13.5 (100/7.4).

for the public debt ratio is set at 70 percent of GDP, which is close to the 75th percentile of its distribution in our sample. The threshold for primary fiscal balances is set at -6 percent of GDP, which roughly corresponds to the 25th percentile of its distribution. For oil prices, the threshold is set at $45 per barrel, which also corresponds to the 25th percentile of the oil price distribution.[4]

Table 2.1.2. Distribution of Fundamentals
(In percent of GDP, unless stated otherwise)

	25th	50th	75th
FX reserves (in months of imports)	2.5	3.5	5.2
Public debt	16.6	37.0	65.1
Primary balance	-5.6	-1.9	4.4
Oil prices (in $ per barrel)	44.0	61.7	78.3

Source: IMF staff calculations.

The estimations suggest that countries with relatively weak fundamentals are prone to more severe adverse spillovers from US monetary policy normalization (Table 2.1.3a). High FX reserves help cushion the impact of increases in US long-term yields on sovereign yields in the region. We find that when reserves are low, in response to a 100-bps increase in the US 10-year Treasury yield, sovereign yields in ME&CA rise by about 77 bps on average, while they rise by only 24 bps when reserves are high. In addition, high primary deficits amplify the spillovers of US monetary policy normalization to yields. On average, sovereign yields rise by about 59 bps in countries where the primary deficit is relatively high while they rise by about 50 bps in those where it is relatively low.

Fundamentals also play a role in limiting or amplifying spillovers to portfolio inflows in the region. On average, portfolio inflows decline by slightly more in countries with low FX reserves relative to those with high FX reserves (0.29 versus 0.27 percent of GDP) in response to a 100-bps increase in the US 10-year Treasury yield. Similarly, in countries with high public debt, portfolio inflows decline by 0.35 percent of GDP while they decline by 0.29 percent of GDP in those with low public debt following a 100 bps rise in the US 10-year yield. A high primary deficit also leads to a larger decline in portfolio inflows after a 100-bps increase in the US 10-year yield (-0.33 percent of GDP versus –0.27 percent of GDP in countries with a low deficit).

Table 2.1.3a. Spillovers from US Monetary Policy Normalization: Role of Fundamentals
(Average response over 6 months to a 100-bps increase in the U.S 10-year Treasury yield)

Yield (in basis points)	Low	High
FX reserves	76.5	23.7
Primary deficit	50.5	59.3
Oil prices (for oil exporters)	72.3	56.1
Portfolio inflows (in percent of GDP)	**Low**	**High**
FX reserves	-0.29	-0.27
Public debt	-0.29	-0.35

[4] Adedeji et al. (2019) find that in GCC countries the impact of an increase in federal funds rate on non-oil GDP fades when oil prices rise above $43 a barrel.

Table 2.1.3a. Spillovers from US Monetary Policy Normalization: Role of Fundamentals *(continued)*

(Average response over 6 months to a 100-bps increase in the U.S 10-year Treasury yield)

Portfolio inflows (in percent of GDP)	**Low**	**High**
Primary deficit	-0.27	-0.33
Oil prices (for oil exporters)	-0.20	-0.11

Source: IMF staff calculations.

Note: Low (High) refers to values of fundamentals below (above) their respective thresholds.

Table 2.1.3b. Spillovers from an Increase in Global Risk Sentiment: Role of Fundamentals

(Average response over 6 months to a one-standard deviation increase in VIX)

Portfolio inflows (in percent of GDP)	**Low**	**High**
FX reserves	-0.21	-0.14
Public debt	-0.13	-0.27
Primary deficit	-0.11	-0.21
Oil prices (for oil exporters)	-0.33	-0.21

Source: IMF staff calculations.

Note: Low (High) refers to values of fundamentals below (above) their respective thresholds.

We also examine the impact of international oil prices, as measured by the price of Brent crude oil, on spillovers to oil-exporting countries from US monetary policy normalization (Table 2.1.3a).[5] We find that when oil prices are less than $45 per barrel, spillovers to oil-exporting countries in the region get amplified. When oil prices are low, sovereign yields amongst oil exporters increase by about 72 bps. In contrast, they increase by 56 bps when oil prices are high. Similarly, when oil prices are low, portfolio inflows to oil exporters decline by 0.2 percent of GDP, while they only decline by 0.11 percent of GDP when oil prices are high. Therefore, in the current environment, high oil prices will likely mitigate spillovers from US monetary policy normalization to oil exporters in ME&CA.

Finally, we examine the role of fundamentals in mitigating or amplifying spillovers from an increase in global risk sentiment (Table 2.1.3b). We find that weaker fundamentals amplify spillovers from an increase in global risk sentiment. A one standard deviation increase in VIX leads to a decline of portfolio inflows by 0.21 percent of GDP in countries with low FX reserves. In contrast, a similar shock leads to a decline of 0.14 percent of GDP in portfolio inflows in countries with high reserves. Similarly, in countries with high public debt (primary fiscal deficit), inflows decline by 0.27 (0.21) percent of GDP, on average, whereas they only decline by 0.13 (0.11) percent of GDP when public debt (primary deficit) is low. Our estimations also suggest that oil-exporting countries suffer less drops in portfolio inflows following an increase in global risk aversion when oil prices are high (-0.21 percent of GDP versus -0.33 percent of GDP when oil prices are low).

[5] To have enough variation in oil prices to effectively examine their role in amplifying or mitigating spillovers, and to circumvent the sample constraints on sovereign bond yield data, we use a proxy of sovereign yields by taking the sum of sovereign spreads—available for most countries since 2002Q1—and the US 10-year Treasury yield.

2.1.4. Robustness Checks

For robustness, we vary the thresholds for the various fundamentals used in this analysis to check whether our key results still hold. At various thresholds for FX reserves, we find that lower reserve coverage is associated with a higher increase in sovereign yields, in response to a hike in US long-term yields—results are invariant to increasing the threshold for FX reserves as the sample composition of countries with low and high reserve coverage does not change (Table 2.1.4). We also find that a lower primary balance and lower oil prices (for oil exporters), under alternative thresholds, consistently lead to a higher increase in yields from monetary tightening in the US. Similarly, we find that lower reserve coverage, higher debt, higher primary deficits, and lower oil prices lead to a larger decline in portfolio inflows following a rise in the US 10-year Treasury yield and global risk aversion as measured by VIX (Table 2.1.5).

Table 2.1.4. Role of Fundamentals in Driving Spillovers to Sovereign Yields
(Average response over 6 months to a 100-bps increase in the U.S. 10-year Treasury yield)

FX Reserves (in percent of GDP)	**Low**	**High**
50	76.5	23.7
60	76.5	23.7
70	76.5	23.7
Primary balance (in percent of GDP)		
-5.5	61.1	47.8
-6.0	59.3	50.5
-7.5	55.3	54.5
Oil prices (in US$ per barrel, only for OEs)		
40	95.7	59.1
45	72.3	56.1
60	53.3	46.0

Source: IMF staff calculations.

Table 2.1.5. Role of Fundamentals in Driving Spillovers to Portfolio Inflows
(Average response over 6 months)

	Impact of a 100 bps rise in the US 10-year Treasury yield		**Impact of one standard deviation rise in VIX**	
FX Reserves (in percent of GDP)	**Low**	**High**	**Low**	**High**
40	-0.3	-0.27	-0.22	-0.14
50	-0.29	-0.27	-0.21	-0.14
Public Debt (in percent of GDP)				
70	-0.29	-0.35	-0.13	-0.21
80	-0.27	-0.33	-0.15	-0.26
Primary Deficit (in percent of GDP)				
5.5	-0.27	-0.3	-0.11	-0.2
6	-0.27	-0.33	-0.11	-0.21
7.5	-0.26	-0.33	-0.13	-0.22

Table 2.1.5. Role of Fundamentals in Driving Spillovers to Portfolio Inflows *(continued)*
(Average response over 6 months)

	Impact of a 100 bps rise in the US 10-year Treasury yield		Impact of one standard deviation rise in VIX	
Oil Prices (in US$ per barrel, only for OE sample)				
40	-0.25	-0.12	-0.39	-0.24
45	-0.2	-0.11	-0.33	-0.21
60	-0.24	-0.15	-0.23	-0.13

Source: IMF staff calculations.
Note: Low (High) refers to values of fundamentals below (above) their respective thresholds.

For robustness, we also estimate the panel VAR using the US 2-year Treasury yield as an alternative measure for US monetary policy normalization, instead of the US 10-year Treasury yield. We find that the results are broadly unchanged (Table 2.1.6).

Table 2.1.6. Spillovers from a 100-bps-increase in the US 2-year Treasury Yield

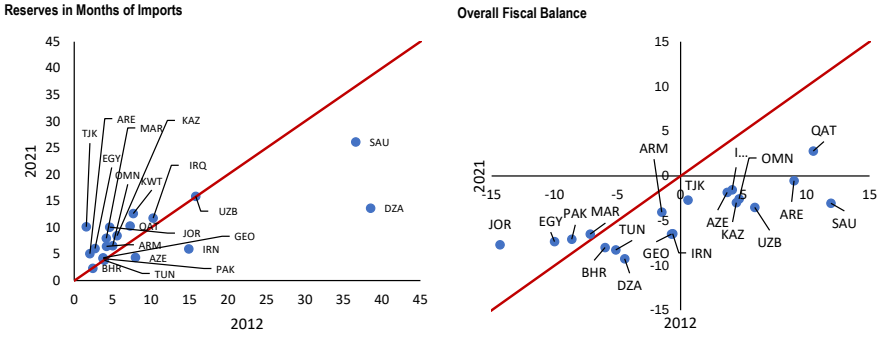
(Average responses: in percentage points, unless stated otherwise)		
Equity	-7.0	
NEER	-5.5	
Sovereign Yields (basis points)	57.3	
Real GDP Growth	-0.28	
Portfolio inflows (in percent of GDP)	-0.17	
Portfolio inflows across fundamentals in percent of GDP (thresholds)	**Low**	**High**
FX Reserves (50%)	-0.19	-0.16
Public Debt (70%)	-0.15	-0.27
Primary Fiscal Deficit (6%)	-0.16	-0.35

Source: IMF staff calculations.
Note: Low (High) refers to values of fundamentals below (above) their respective thresholds.

2.1.5. Additional Fundamentals: 2012 vs 2021

The chart on the left-hand side in Figure 2.1.1 shows that, in most ME&CA countries, foreign exchange reserves to imports have increased in 2021 relative to their level in 2012 when the region faced the taper tantrum announcement. The chart on the right-hand side shows that fiscal balances deteriorated in 2021 compared to their level in 2012 in most of the region's countries.

Figure 2.1.1. Additional Fundamentals in 2012 and 2021



Source: IMF World Economic Outlook Database; and IMF staff calculations

Online Annex 2.2. Global Financial Conditions and Portfolio Inflows to ME&CA

2.2.1. Methodology and Data

To quantify spillovers from tightening global financial conditions to portfolio inflows in ME&CA, this analysis adopts the empirical framework employed in the October 2019 MCD Regional Economic Outlook while extending the sample period and augmenting the capital flow model with additional "pull" factors. The analysis uses annual country-level data, including balance of payments portfolio inflows, over the 1990-2021 period for two separate samples covering ME&CA countries and other EMs. The ME&CA sample includes 14 countries, of which 7 are oil exporters (Azerbaijan, Bahrain, Kazakhstan, Kuwait, Oman, Qatar, and Saudi Arabia) and 7 are oil importers (Armenia, Egypt, Georgia, Jordan, Morocco, Pakistan, and Tunisia). The following empirical model is estimated for ME&CA and other EMs:

$$Pinf_{i,t} = \beta_0 + \beta_1 US\_Yield_t + \beta_2 \ln(VIX)_t + \beta_3 g(Oil)_t + \sum_{j=4}^{J} \beta_j X_{j,i,t} + \varepsilon_{i,t} \quad (2)$$

where $Pinf_{i,t}$ represents portfolio inflows scaled by GDP in country i, in year t, US_Yield_t represents the US 10-year Treasury yield in year t, VIX_t represents the CBOE implied volatility index in year t, $g(Oil)_t$ is the annual growth rate of oil prices, $X_{i,t}$ represents a set of country variables capturing "pull" factors (economic growth, capital account openness, and quality of institutions) and $\varepsilon_{i,t}$ is an error term.[6] Table 2.2.1 describes the variables used in the analysis. Tables 2.2.2 and 2.2.3 report summary statistics for the main variables used in analysis for the ME&CA and EMs samples, respectively.

Table 2.2.1. Variables' Descriptions and Sources

Variable	Description	Source
Portfolio Inflows	Balance of Payment's Net Incurrence of Portfolio Liabilities as a percentage of GDP. Net incurrence of portfolio liabilities accounts for non-resident inflows and outflows to/from domestic debt and equity markets.	IMF World Economic Outlook, Balance of Payments
Real GDP Growth	Annual growth in real GDP.	IMF World Economic Outlook.
Oil Price Growth	Annual growth in yearly average international Brent oil price.	Bloomberg
Financial Markets' Depth	Financial Markets Depth is a subindex of the IMF Financial Development Index. It compiles data on stock market capitalization to GDP, stocks traded to GDP, international debt securities of government to GDP, and total debt securities of financial and non-financial corporations to GDP.	IMF Financial Development Index Database
Log (VIX)	Natural logarithm of the Chicago Board Options Exchange (CBOE) Volatility Index.	FRED Database
US 10-year Treasury Yield	Market yield on US Treasury securities at 10-year constant maturity	FRED Database

[6] As in the MCD October 2019 REO, we measure portfolio inflows by the BOP "net incurrence of portfolio liabilities", which is inclusive of non-resident inflows and outflows to/from local debt and equity markets.

Table 2.2.1. Variables' Descriptions and Sources *(continued)*

Variable	Description	Source
ICRG	International Country Risk Guide composite risk index measuring a country's risk profile. Values range between 0 and 100, with high values indicating less risk.	The PRS Group
Capital Openness	Chinn-Ito Capital Account Openness Index scaled between 0 and 1, with higher values indicating more capital account openness.	Chinn-Ito
Sovereign Credit Rating	For each country and year, the average of three sovereign credit ratings by Standard & Poor's, Fitch, Moody's. Credit ratings are converted into numerical values between –6 and 10. The lowest rating by each agency is assigned –6 while the highest rating is assigned 10.	Bloomberg
Public Debt to GDP	Stock of sovereign debt divided by annual gross domestic product	IMF World Economic Outlook
FX Reserves to GDP	Stock of official international reserves divided by annual gross domestic product	IMF World Economic Outlook

Source: IMF staff calculations.

Table 2.2.2. Summary Statistics for the ME&CA Sample

	25th	50th	75th	Mean	Std
Portfolio Inflows (percent of GDP)	0	0.17	0.91	0.86	2.42
Real GDP Growth (percentage change)	2.08	4.09	6.46	3.92	7.71
ICRG Risk Index (units)	64.75	71	75.5	69.97	8.34
Capital Openness (units)	0.16	0.7	1	0.59	0.37

Source: IMF staff calculations.

Table 2.2.3. Summary Statistics for the EM Sample

	25th	50th	75th	Mean	Std
Portfolio Inflows (percent of GDP)	0	0.21	1.46	0.91	2.25
Real GDP Growth (percentage Change)	1.82	4.16	6.28	3.66	4.24
ICRG Risk Index (units)	62.75	67.5	71.52	66.56	7.52
Capital Openness (units)	0.164	0.417	0.7	0.43	0.31

Source: IMF staff calculations.

2.2.2. Regression Results

Results of the regression analysis using the US 10-year Treasury yield, VIX, and oil prices as explanatory variables are reported in columns (1)-(2) of Table 2.2.4. The results are consistent with Eichengreen, Gupta, and Masetti (2018) and suggest that portfolio inflows to both EMs and ME&CA are sensitive to changes in US interest rates and global risk sentiment.

Including additional variables capturing "pull" factors, such as real GDP growth, capital account openness, and the ICRG composite index as well as year dummy variables in columns (3)-(4) does not alter our finding of a negative and statistically significant association between the US 10-year Treasury yield and VIX on one hand and portfolio inflows-to-GDP on the other hand. Oil price growth is positively and statistically significantly associated with portfolio inflows in ME&CA. In column (5), an interaction term

between a dummy variable that takes on one for oil-exporters and zero otherwise and oil price growth is included in the regression model. The estimation suggests that the positive impact of oil prices on portfolio inflows accrues only to oil-exporting countries. Higher oil prices increase portfolio inflows to oil exporters, given the improvement in oil exporters' sovereign risk profiles. While real GDP growth appears positive across all regression specifications, it is, however, statistically insignificant.[7]

Columns (6)-(7) further include dummy variables capturing the strength of economic fundamentals (public debt-to-GDP, FX reserves-to-GDP, and sovereign ratings) as well as country fixed effects. These measures of economic fundamentals cannot be precisely identified at annual frequency, but the result on the association between US yields and VIX and portfolio inflows continues to hold. Moreover, in most reported specifications, ME&CA countries in the sample are, on average, more sensitive to changes in financial conditions and risk sentiment than other EMs.

To assess the potential role of financial markets in mitigating or amplifying spillovers to ME&CA from US monetary policy tightening and worsening global risk sentiment, we augment the portfolio inflows models reported in Table 2.2.4 with an interaction variable between a measure of financial markets' depth and the US 10-year Treasury yield (Table 2.2.5) and an interaction variable between a measure of financial markets' depth and VIX (Table 2.2.6). In both tables, market depth is a dummy variable that takes on 1 if the value of Financial Markets' Depth (as described in Table 2.2.1) is higher than the sample median in each year and 0 otherwise. The estimations suggest that countries with more developed financial markets suffer less declines in their portfolio inflows due to a rise in US interest rates or global market uncertainty. This result is robust across both samples (ME&CA and EMs) and model specifications. Importantly, the result that US monetary policy tightening and rise in global risk aversion drive down portfolio inflows in ME&CA by more than they do in other EMs continues to hold.

Table 2.2.4. Panel-data Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	EM	ME&CA	EM	ME&CA	ME&CA	EM	ME&CA
Portfolio Inflows/GDP							
US Yield	-0.156***	-0.305***	-0.140***	-0.249**	-0.264**	-0.193***	-0.204*
	(0.038)	(0.062)	(0.053)	(0.116)	(0.122)	(0.055)	(0.120)
Log of VIX	-1.241***	-0.810*	-0.891***	-1.208**	-1.215**	-1.012***	-1.239**
	(0.257)	(0.460)	(0.332)	(0.554)	(0.543)	(0.336)	(0.519)
Oil price growth	-0.002	0.010**	-0.003	0.011**	-0.000	-0.004	0.013**
	(0.003)	(0.005)	(0.003)	(0.005)	(0.004)	(0.003)	(0.006)
(Oil Exporter) * Oil Price (growth)					0.023**		
					(0.010)		
Real GDP growth			0.059	0.036	0.079	0.167**	0.072
			(0.068)	(0.069)	(0.081)	(0.078)	(0.085)
Capital Openness			0.275	1.689***	1.430***	0.274	0.525
			(0.265)	(0.474)	(0.437)	(0.381)	(0.596)
ICRG			0.059***	0.003	-0.023	0.033**	-0.032
			(0.011)	(0.020)	(0.024)	(0.015)	(0.038)
Year dummy controls	X	X	YES	YES	YES	YES	YES

[7] Similarly, BIS (2021) reports a statistically insignificant association between economic growth and portfolio inflows in a sample of EMDEs.

Table 2.2.4. Panel-data Regression Results *(continued)*

VARIABLES	(1) EM	(2) ME&CA	(3) EM	(4) ME&CA	(5) ME&CA	(6) EM	(7) ME&CA
Additional country-level variables	X	X	X	X	X	YES	YES
Country Fixed Effects	X	X	X	X	X	YES	YES
Observations	953	407	870	347	347	870	347
R-squared	0.039	0.062	0.088	0.130	0.159	0.184	0.239

Source: IMF staff calculations.

Note: Columns (3)-(7) include lagged real GDP growth, lagged ICRG composite index, Ito-Chinn capital openness index, global financial crisis and COVID-19 dummy variables (that is, time dummy controls). Columns (6)-(7) include country fixed effects as well as three additional country-level control dummy variables that take on 1 if the variable's value is above the annual median and 0 otherwise (FX reserves-to-GDP, public debt-to-GDP, average sovereign credit rating). Robust standard errors clustered at country levels are reported in parentheses. EM: emerging market; ME&CA: Middle East and Central Asia. *** p<0.01, ** p<0.05, * p<0.

Table 2.2.5. Panel-data Regression Results (Financial Markets Depth and US Yields)

VARIABLES	(1) EM	(2) ME&CA	(3) EM	(4) ME&CA	(5) EM	(6) ME&CA	(7) EM	(8) ME&CA
US Yield	-0.156***	-0.305***	-0.218***	-0.426***	-0.163***	-0.429***	-0.247***	-0.335***
	(0.038)	(0.062)	(0.044)	(0.072)	(0.053)	(0.121)	(0.054)	(0.127)
Log of VIX	-1.241***	-0.810*	-1.209***	-1.036**	-0.946***	-1.310**	-1.065***	-1.371***
	(0.257)	(0.460)	(0.263)	(0.436)	(0.326)	(0.533)	(0.335)	(0.504)
Oil price growth	-0.002	0.010**	-0.003	0.010**	-0.004	0.011**	-0.005	0.012**
	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)
US Yield * Market Depth			0.486***	0.671***	0.371***	0.621***	0.719***	0.541*
			(0.115)	(0.166)	(0.119)	(0.188)	(0.269)	(0.308)
Real GDP growth					0.047	-0.014	0.151*	0.042
					(0.071)	(0.062)	(0.081)	(0.078)
Capital Openness					0.368	0.943**	-0.008	0.734
					(0.265)	(0.420)	(0.373)	(0.606)
ICRG					0.043***	-0.019	0.035**	-0.039
					(0.011)	(0.020)	(0.015)	(0.038)
Year Dummy Controls	X	X	X	X	YES	YES	YES	YES
Additional Country Level Variables	X	X	X	X	X	X	YES	YES
Country Fixed Effects	X	X	X	X	X	X	YES	YES
Observations	953	407	891	380	870	347	870	347
R-squared	0.039	0.062	0.071	0.134	0.101	0.167	0.194	0.251

Table 2.2.5. Panel-data Regression Results (Financial Markets Depth and US Yields) *(continued)*

Source: IMF staff calculations.

Note: Columns (5)-(8) include lagged real GDP growth, lagged ICRG composite index, Ito-Chinn capital openness index, global financial crisis and COVID-19 dummy variables (that is, time dummy controls). Market Depth is a dummy variable equal to 1 if the value is higher than the sample's median. Columns (7)-(8) include country fixed effects as well as three additional country-level control dummy variables that take on 1 if above the annual median and 0 otherwise (FX reserves-to-GDP, public debt-to-GDP, average sovereign credit rating). Robust standard errors clustered at the country level are reported in parentheses. EMs: emerging market and developing economies; ME&CA: Middle East and Central Asia. *** p<0.01, ** p<0.05, * p<0.

Table 2.2.6. Panel-data Regression Results (Financial Markets Depth and VIX)

VARIABLES	(1) EM	(2) ME&CA	(3) EM	(4) ME&CA	(5) EM	(6) ME&CA	(7) EM	(8) ME&CA
US Yield	-0.156***	-0.305***	-0.144***	-0.253***	-0.095*	-0.288***	-0.103	-0.203*
	(0.038)	(0.062)	(0.044)	(0.065)	(0.054)	(0.110)	(0.063)	(0.115)
Log of VIX	-1.241***	-0.810*	-1.287***	-1.354***	-1.010***	-1.604***	-1.179***	-1.801***
	(0.257)	(0.460)	(0.260)	(0.429)	(0.323)	(0.523)	(0.338)	(0.501)
Oil price growth	-0.002	0.010**	-0.002	0.011**	-0.003	0.012**	-0.005	0.011**
	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)
Log of VIX * Market Depth			0.709***	1.165***	0.586***	1.255***	1.163***	1.553***
			(0.167)	(0.250)	(0.167)	(0.300)	(0.396)	(0.490)
Real GDP growth					0.051	-0.022	0.155*	0.017
					(0.070)	(0.064)	(0.081)	(0.077)
Capital Openness					0.435*	0.636	0.229	0.394
					(0.263)	(0.399)	(0.373)	(0.583)
ICRG					0.042***	-0.029	0.040**	-0.039
					(0.011)	(0.019)	(0.016)	(0.036)
Year Dummy Controls	X	X	X	X	YES	YES	YES	YES
Additional Country Level Variables	X	X	X	X	X	X	YES	YES
Country Fixed Effects	X	X	X	X	X	X	YES	YES
Observations	953	407	891	380	870	347	870	347
R-squared	0.039	0.062	0.072	0.157	0.104	0.189	0.194	0.266

Source: IMF staff calculations.

Note: Columns (5)-(6) include lagged real GDP growth, lagged ICRG composite index, Ito-Chinn capital openness index, global financial crisis and COVID-19 dummy variables (that is, time dummy controls). Market depth is a dummy variable equal to 1 if the value is higher than the sample's median. Columns (7)-(8) include country fixed effects as well as three additional country-level control dummy variables that take on 1 if above the annual median and 0 otherwise (FX reserves-to-GDP, public debt-to-GDP, average sovereign credit rating). Robust standard errors clustered at country levels are reported in parentheses. EMs: emerging market and developing economies; ME&CA: Middle East and Central Asia. *** p<0.01, ** p<0.05, * p<0.

2.2.3. Stress-testing Portfolio Inflows in ME&CA

Portfolio inflows to ME&CA are stress-tested under three scenarios. Marginal effects on portfolio inflows are calculated using the estimated coefficients on the US 10-year Treasury yield and VIX (in column (4) of Table 2.2.4) and scenario parameters for these two variables in 2022.

$$\widehat{\Delta Pinf}_{i,2022} = \hat{\beta}_{US\_Yield} * \Delta US_{Yield\ 2022} + \hat{\beta}_{\ln_{VIX}} * \Delta_{\text{VIX}}$$

Table 2.2.7 and Figure 2.2.1 describe the baseline and shock scenarios as well as the simulated impact on portfolio inflows.

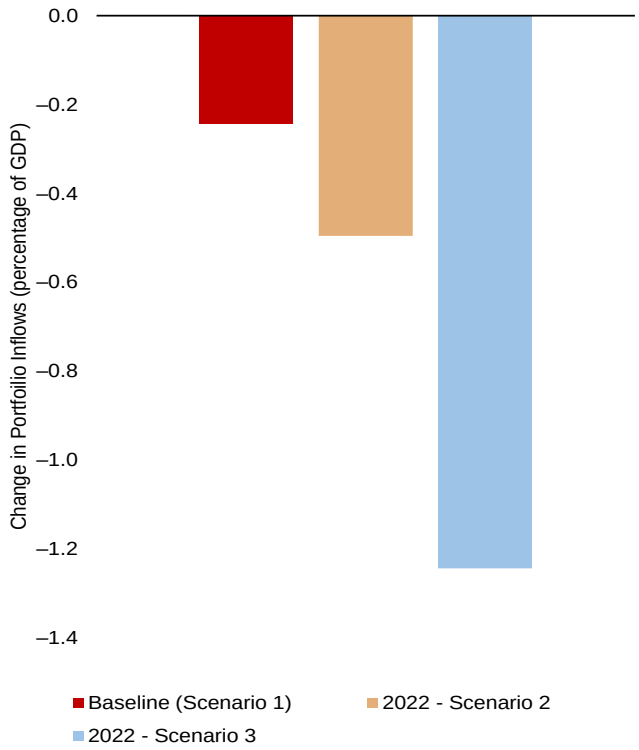
Table 2.2.7. Scenarios Used to Stress Test Portfolio Inflows to ME&CA

Scenario 1: Baseline, $\Delta US\_Yield_{2022} = 100$ bps (broadly in line with WEO projections), $\Delta_{\text{VIX}} = 0$; Therefore, $\Delta\widehat{PInf}_{i,2022} = \hat{\beta}_{US\_Yield} * 100bps$
Scenario 2: $\Delta US\_Yield_{2022} = 200$ bps, $\Delta_{\text{VIX}} = 0$. In this scenario, global financial conditions are assumed to be tighter-than-expected through an additional 100-bps increase in the US 10-year Treasury yield (in line with the rise during the 2013 Taper Tantrum episode). $\Delta\widehat{PInf}_{i,2022} = \hat{\beta}_{US\_Yield} * 200\ bps$
Scenario 3: $\Delta US_{Yield_{2022}} = 200$ bps, $\Delta_{\text{VIX}} = \frac{2\sigma_{VIX}}{VIX_{2021}}$. In this scenario, we add to scenario 2 an increase of the VIX by 2 standard deviations (of its historical distribution since 2000). The change in the VIX is similar to the increase in the global uncertainty index during the 2018 Federal Reserve tightening episode. $\Delta\widehat{PInf}_{i,2022} = \hat{\beta}_{US\_Yield} * 200bps + \hat{\beta}_{\ln_{VIX}} \left(\frac{2\sigma_{VIX}}{VIX_{2021}}\right)$

Source: IMF staff calculations.

Note: *PInf*: Portfolio inflows in percent of GDP.

Figure 2.2.1. Portfolio Inflows Stress Tests (U.S. Tightening and Global Uncertainty)



Source: IMF staff calculations
Note: Baseline (scenario 1): a 100 bps increase in the U.S. 10-year Treasury yield. scenario 2: a 200 bps increase in the US 10-year treasury yield. scenario 3: a 200 bps increase in the US 10-year treasury yield and a two standard deviations increase in VIX in 2022 relative to 2021. bps = basis points. VIX = Chicago Board Options Volatility Index.

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