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Financial Stability in a Higher-for-Longer Interest Rate Environment

The Case of the Middle East and North Africa

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Financial Stability in A Higher-for-Longer Interest Rate Environment
The Case of the Middle East and North Africa

Prepared by Adrian Alter, Bashar Hlayhel, Thomas Kroen, Thomas Piontek *

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ABSTRACT: This paper assesses the state and resilience of corporate and banking sectors in the Middle East and North Africa (MENA) in a "higher-for-longer" interest rate environment using granular micro data to conduct the first cross-country corporate and banking sector stress tests for the MENA region. The results suggest that corporate sector debt at risk may increase sizably from 12 to 30 percent of total corporate debt. Banking systems would be broadly resilient in an adverse scenario featuring higher interest rates, corporate sector stress, and rising liquidity pressures with Tier-1 capital ratios declining by 2.3 percentage points in the Gulf Cooperation Council (GCC) countries and 4.0 percentage points in non-GCC MENA countries. In the cross-section of banks, there are pockets of vulnerabilities as banks with higher ex-ante vulnerabilities and state-owned banks suffer greater losses. While manageable, the capital losses in the adverse scenario could limit lending and adversely impact growth.

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WORKING PAPERS

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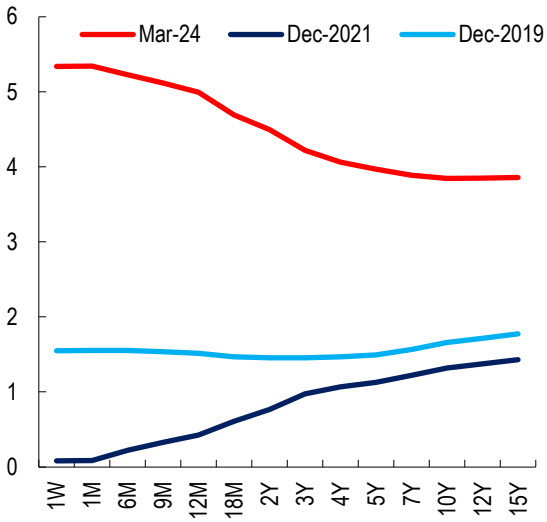
1. Introduction

In March 2023, the sudden failures of Silicon Valley Bank and Signature Bank in the United States and the loss of market confidence in Credit Suisse, a global systemically important bank in Europe, highlighted the challenges posed by the interaction between tighter monetary and financial conditions and the buildup in vulnerabilities. After years of low interest rates, higher interest rates amid tighter monetary policy are challenging banks' effective risk management in securities portfolios and loan exposures. Furthermore, with inflation still high in many parts of the world, central banks may need to keep interest rates higher for longer than currently priced in markets, slowing economic momentum. Following large-scale forbearance during the pandemic, corporate bankruptcies have also started ticking up as rising interest rates put pressure on highly leveraged businesses. In this context, a prolonged period of tighter monetary policy could have unintended consequences for financial systems and corporate sectors in the Middle East and North Africa (MENA).

The fundamental question confronting market participants and policymakers in the MENA region is whether the events of March 2023 are a harbinger of more systemic stress that will test the resilience of the global financial system—a canary in the coal mine—or simply the isolated manifestation of challenges from tighter monetary and financial conditions after more than a decade of ample liquidity. Despite some signals that the monetary policy tightening cycle has ended, financial market participants expect policy rates to remain elevated for a prolonged period and at much higher levels than expected just two years ago. Figure 1 shows how the entire overnight indexed swaps (OIS) curve has moved up substantially both at the short and long end since December 2021.

Figure 1: US Federal Funds Overnight Indexed Swaps Curve (percent)



Source: Bloomberg Finance L.P
Note: An OIS is an interest rate derivative contract in which a fixed interest rate (the OIS rate) payment is swapped for a floating-interest payment during the tenor of the contract. It is used as a measure of monetary policy expectation.

This "higher-for-longer" interest rate environment could affect financial conditions and trigger strains across financial institutions in the MENA region. This is particularly relevant as vulnerabilities may be hidden due to accounting rules or regulatory treatments that can temporarily mask exposures and losses, and some holdings are concentrated in certain asset classes, such as government bonds. The banking sector stress in March 2023 provided a stark reminder that funding can evaporate rapidly, and a reliance on foreign funding sources is a key financial vulnerability. Banks could also face a deterioration in asset quality from interest-rate-sensitive borrowers who suddenly face challenges in servicing their debt. An escalation in such stress could have significant repercussions for banking sector profitability and credit provision and materially affect economic growth and financial stability. Likewise, the corporate sector in the MENA region may be tested by rising interest rates. Higher debt servicing costs depress interest rate coverage ratios, which may be compounded by declining profitability if economic growth moderates.

In this paper, we stress test MENA corporate and banking sectors in a higher-for-longer interest rate environment. To our knowledge, this is the first cross-country study with a corporate and banking sector stress test for countries

in the MENA region. Our stress testing exercises rely on publicly available microdata and are thus easy to replicate and update. Microdata are critical since aggregate banking sector indicators, such as system-wide capital or liquidity ratios, may mask heterogeneity across banks. Moreover, the methodology and scenarios are common across countries to facilitate cross-country comparisons and hence can also readily be adapted for other countries in the region that are not covered. Thus, our exercises are complementary to more granular country-level stress tests (based on confidential supervisory data) that the respective central banks in MENA countries conduct.

Our stress testing exercises aim to answer three questions. First, what would be the impact of a higher for longer interest rates environment on the corporate sectors in MENA? Higher rates directly increase debt servicing costs, thus weighing on interest coverage ratios, which could adversely affect firm profitability and increase debt at risk. Amid widespread subsidized lending in the region, "zombie credit"—credit to firms with low interest coverage ratios at preferential rates (Acharya and others 2022)—could increase substantially. Our corporate sector stress simulates the impact of a 100-basis point (bps) increase in interest rates for two subsequent years, respectively, and a negative profitability shock affecting more than 1,000 firms in the MENA region. We infer the implied increase in nonperforming loans (NPLs) from the deterioration in the distribution of interest rate coverage ratios in the corporate sector stress test.

The second question is how resilient banks would be in a higher-for-longer scenario. Increasing corporate sector stress would increase banks' provisioning needs, decreasing net income. Moreover, rising rates lead to accumulating (unrealized) capital losses on fixed-income securities on banks' balance sheets, adversely affecting banks' ability to weather liquidity shocks (Jiang and others 2023). Hence, our banking sector stress test quantifies banks' losses under liquidity and credit quality shocks and the interaction of the two. In addition, we estimate the impact of rising interest rates on banks' net interest margins following the methodology of Schnabl and others (2021). Higher corporate default rates and increasing unrealized capital losses in a higher-for-longer interest rate environment may be partly offset by increasing net interest margins, particularly for banks whose assets reprice faster than liabilities. Since our data are publicly available, these results can easily be replicated and updated, and different scenarios could be considered as the business cycles in the region evolve.

Third, we ask how banking sector stress would affect macroeconomic outcomes in the region. Using a local projections approach (Jordà 2005), we estimate the link between bank capital and credit provision. This provides us with an estimate of how much credit would contract if banks' Tier-1 capital ratios were to decline as in the banking sector stress scenario. We then use a small-scale macro-econometric model to estimate the elasticity of output to changes in credit provision and simulate counterfactuals for the time path of output in the banking sector stress scenario.

The results suggest that corporate sector debt at risk could increase sizably in a higher-for-longer scenario, with zombie-held debt rising from 12 percent to 30 percent of total corporate debt at publicly listed firms in the region. The banking systems in the region would largely be resilient if corporate sector stress or liquidity stress materialized in isolation. However, in the joint scenario of higher interest rates, corporate sector stress, and liquidity pressures, pockets of vulnerability exist in some countries since buffers that provide resilience against isolated liquidity or credit stress can only be deployed once. In the joint stress scenario, capital losses amount to a 2.3 percentage point decline in Tier-1 capital ratios in the Gulf Cooperation Council (GCC) and a 4-percentage point decline in non-GCC MENA. While few banks would become undercapitalized, lower bank capital could limit lending and add to downside risks to output. On average, output would decline by 0.4 percent in the GCC in the

adverse banking sector stress scenario, while non-GCC MENA economies would witness a 0.7 percent contraction in output.

Contribution to the Literature

This paper contributes to three broad strands of the literature.

First, our paper contributes to the literature on zombie firms by investigating the effects of higher debt service burden on corporate balance sheets. Consistent with the existing literature (for example, Albuquerque and Iyer 2023; Acharya and others 2022), our findings suggest a substantial deterioration of the corporate sector's financial health after major shocks, including the Global Financial Crisis (2007–08) and the oil price slump (2015). Historically, the share of zombie firms more than doubles about 2–3 years after the shock, from 10–15 percent in tranquil times to 30–40 percent in the aftermath of crises. These findings are important for the real economy, given that zombie firms are typically less productive and are associated with lower employment and capital investment when compared to healthy firms (Banerjee and Hofmann 2018). In our adverse scenarios, the share of zombie firms increases from about 12 percent in 2022 to almost 30 percent by the end of 2024, with a relatively higher impact on transportation, capital goods, and food and beverage sectors.

Second, our paper contributes to the literature on financial sector resilience in the face of higher interest rates. A rapidly emerging body of literature discussed the impact of higher rates on banking systems during the most recent global tightening cycle (Caldara and others 2023). Still, it focused mainly on advanced economies, particularly the United States (Acharya and others 2023, Choi and others 2023, Copestake and others 2023, Granja 2023, Jiang and others 2023). This literature emphasizes how the combination of large unrealized capital losses on banks' fixed income assets (Jiang and others 2023), concentrated depositor bases (Benmelech and others 2023; Cookson and others 2023), and uninsured leverage (Drechsler 2023) created mutually amplifying vulnerabilities. We add to this literature a distinct banking sector stress test for 10 of the largest banking systems in the MENA region, which considers both liquidity risk and credit risk in isolation and the interaction of the two in a higher-for-longer interest rate environment. Moreover, we explicitly consider the interaction of liquidity shocks with shocks to credit quality—from the corporate sector stress test, which is not directly incorporated in the previous literature (for example, Jiang and others 2023).

Finally, our paper contributes to the literature on macrofinancial linkages from banking sector stress to the broader economy. Existing literature highlights that banks and bank behavior can affect aggregate outcomes through credit provision (Kiyotaki and Moore 1997; Brunnermeier and Sannikov 2014; Amiti and Weinstein 2018). Empirical studies include Acharya and others (2018), Blattner and others (2023), and Greenwald and others (2023). Our paper empirically quantifies the output losses that may result from reduced credit provision in MENA countries if banking sector stress were to materialize in the region. This also adds to the literature on macrofinancial linkages in the MENA region, which emphasizes the link between bank profitability and growth (Aziz 2020) and the role of institutions (Rachdi and others 2018). Our paper highlights the link between bank capital, lending, and growth.

Section 2 provides an overview of the data and recent trends in the region's corporate and banking sectors. Section 3 outlines the corporate sector stress test. Section 4 details the banking sector stress test and how it incorporates the corporate sector results. Section 5 discusses results from the banking sector stress test and macro-financial linkages. Section 6 discusses the status of macroprudential policy in the region, and section 7 concludes.

2. Data

The primary data sets are bank-level and firm-level data, described below. Subsequently, this section gives an overview with stylized facts of the banking and corporate sectors in the Middle East and North Africa.[1]

2.1. Datasets

2.1.1. Bank-level Data

Bank-level data is from Fitch Connect, which provides comprehensive balance sheet and income statement data for banks in the region, including publicly listed, privately held, and state-owned banks. Within each country, we use consolidated financial statements to focus on the financial health of parent companies. For the banking sector stress test, we keep all countries in the MENA region with at least five banks with available data for the end of 2022 or a more recent date to ensure that the stress test is conducted with timely bank-level information. The final sample comprises 108 banks from 10 countries (Bahrain, Egypt, Jordan, Kuwait, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, United Arab Emirates). To gauge the representativeness of our sample of banks, we compare it country-by-country to aggregate banking sector assets from the IMF's International Financial Statistics and Banker's Almanac. Our sample covers at least 78 percent of banking assets in each country.

Table 1. Bank Summary Statistics

	GCC	MENA (excl. GCC) and Pakistan
Total assets (US$, million)	49,545.66	17,143.61
Tier-1 capital ratio (%)	17.5	14.78
Return on assets (RoA) (%)	1.82	1.23
Loan share	0.61	0.48
Government bond share	0.12	0.29
Cash share	0.08	0.07
Deposit share	0.74	0.75
NPL ratio (in %)	5.24	5.8
Provisioning ratio (in %)	1.33	1.3
N	61	47

Table 1 provides an overview of the banks in the sample using the most recent available data point for each bank.[2] On average, GCC[3] banks are about three times larger than banks in the remaining MENA countries and Pakistan (average assets of $49.5 billion versus $17.1 billion), reflecting the prominence of some GCC countries as regional financial centers. GCC banks also have higher Tier-1 capital ratios (17.5 percent versus 14.8 percent) and are more profitable (return on assets, ROA, of 1.82 percent versus 1.23 percent). The balance sheet composition varies across the two regions. GCC banks primarily lend (loan share of 61 percent of assets), and the remainder is split between government bond holdings (12 percent), other securities holdings, other business activities, and cash. MENA banks outside the GCC have a substantially higher share of sovereign bond holdings (29 percent), reflecting the elevated bank-sovereign nexus in the region,[4] while the lending share is significantly

[1] The MENA acronym includes the following countries: Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Somalia, Syria, the United Arab Emirates, West Bank and Gaza, and Yemen.

[2] Time series patterns for the banks in the sample are discussed in section 2.2.

[3] The Gulf Cooperation Council (GCC) includes Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

[4] For a broader discussion of the bank-sovereign nexus in emerging markets, see Deghi and others (2022).

lower at 48 percent. Asset quality is slightly higher in the GCC (NPL ratio of 5.24 percent versus 5.80 percent). Across both regions, the average bank has a provisioning ratio of about 130 percent.

2.1.2. Firm-level Data

The corporate sector analysis relies primarily on the S&P's Capital IQ dataset, covering balance sheet and income statement items for more than a thousand publicly listed firms from 15 MENA countries and Pakistan at the annual frequency.[5] For 2022, about 400 firms are from the GCC region while nearly 700 firms are from the rest of the MENA region and Pakistan. Pakistan, Saudi Arabia, and Egypt each have over 100 firms, whereas Jordan, Kuwait, Oman, Morocco, and Tunisia have between 50 and 100 firms. In 2022, the median firm had about $130 million in total assets, with the median firm from the GCC region about seven times larger than the rest of the MENA region and Pakistan. Regarding profitability, the median firm from the GCC had an EBITDA (earnings before interest, taxes, depreciation, and amortization—a measure of a firm's short-term operational efficiency) of about $23 million, while that of the non-GCC median firm was $5 million.

2.1.3. Other Data

For the banking sector stress tests, we merge the bank-level data with country level information on banking sector foreign liabilities from the IMF's International Financial Statistics. To compute the duration of outstanding government bonds, we use data from Bloomberg LP and follow the methodology outlined in Copestake and others (2023). Finally, when aggregating at the country level to estimate macrofinancial linkages, we use country-level credit data, which we obtain from Haver Analytics (series: "banking sector claims on the non-financial private sector").

2.2. Stylized Facts about MENA Corporate Sectors

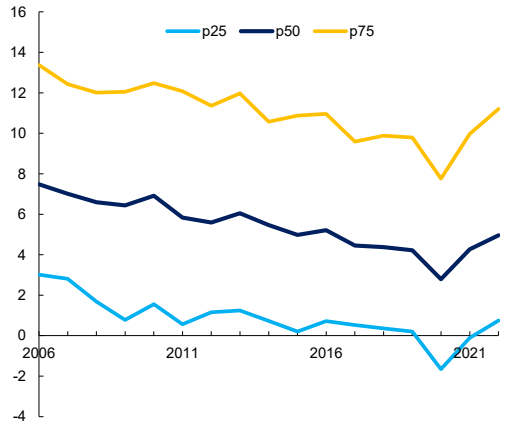
2.2.1. Overview

Over the past few decades, the corporate sector in the ME&CA region suffered major structural transformations. For instance, the profitability of listed firms in the region was declining before the pandemic (Figure 2.1), with the median return on assets falling from about 7.5 percent in 2006 to 5.5 in 2019. At the same time, the corporate sector generally became more indebted, reaching levels of about 20 percent for the median leverage ratio, proxied by the share of total liabilities to assets (Figure 2.2). Importantly, one-quarter of firms had a leverage ratio exceeding 40 percent. The median maturity of long-term corporate debt has been stable (at between three and four years), but one-quarter of listed firms have relatively short-duration debt of less than two years (Figure 2.3).

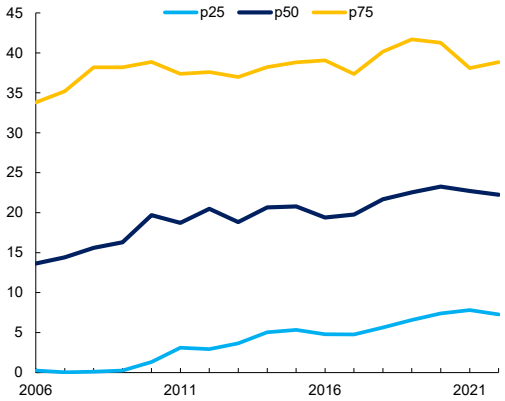
[5] The country sample for the corporate sector analysis covers Pakistan and 15 MECA countries: Azerbaijan, Bahrain, Egypt, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Tunisia, and United Arab Emirates. The set of countries with a less representative sample includes Azerbaijan, Kyrgyzstan, Lebanon, and Sudan, with less than 10 firms each. Results are robust to excluding these countries. For robustness purposes, we also re-ran the analysis with Compustat data and obtain similar findings.

Figure 2. Corporate Sector Health

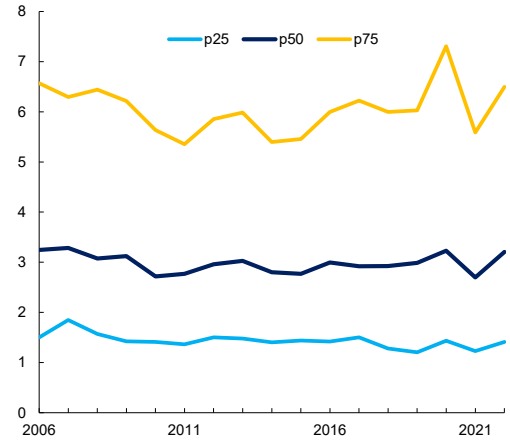
1. Corporate Sector: Profitability (Return on assets, percent)



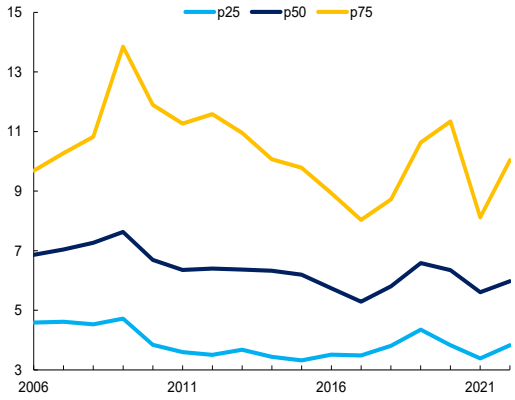
2. Corporate Sector: Leverage Ratio (Total liabilities to total assets; percent)



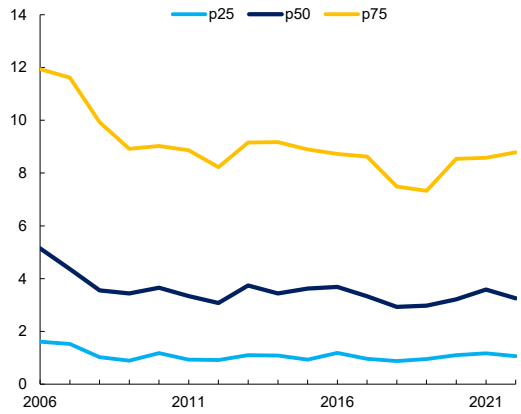
3. Corporate Sector: Maturity of Long-term Debt (Years)



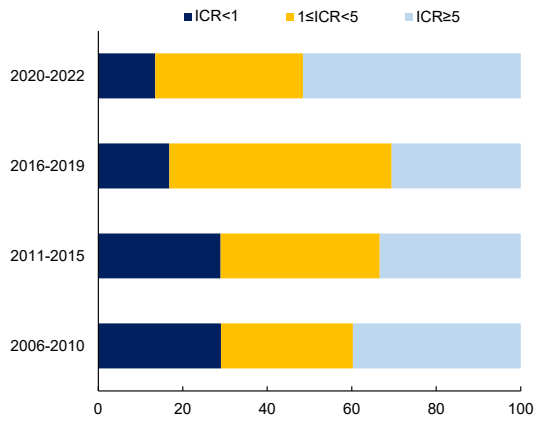
4. Corporate Sector: Effective Interest Rates (Percent)



5. Corporate Sector: Cash Ratio (Cash to total assets, percent)



6. Corporate Sector: Share of Firms by Interest Coverage Ratio (years)



Sources: S&P Capital IQ; and IMF staff calculations.

Note: ICR = Interest coverage ratio; EBIT = Earnings before interest and taxes;

Historically, the median effective interest rate hovered near 6 percent, but the trends have some distinct features (Figure 2.4). First, corporate rates peaked in 2009 following the global financial crisis, when the median interest rate reached 7.5 percent; interest rates for the top 25 percent of riskiest firms were almost twice that amount. Second, corporate rates bottomed out near the 5 percent threshold in 2017, coinciding with the start of a tightening cycle in global financing conditions. Turning to corporate buffers, the median firm typically holds about 4 percent of total assets in cash and cash equivalents (Figure 2.5.). However, some firms keep these liquid buffers closer to 10 percent of total assets due to operational needs or precautionary purposes. The top quarter most liquid firms significantly increased their cash buffers (by about 1 percentage point) before the pandemic.

The COVID-19 shock adversely impacted the corporate sector—particularly for contact-intensive industries—but strong policy support in ME&CA helped mitigate the overall impact. Although the corporate sector has broadly recovered, some nonfinancial firms could become vulnerable in a higher-for-longer interest rate environment. Importantly, the share of firms with an interest coverage ratio (ICR) below 1 has declined to about 10 percent of the total in the aftermath of the pandemic (Figure 2.6). Likewise, the portion of debt held by firms with an ICR between 1 and 5 has almost halved from pre-pandemic levels, representing about 25 percent of the total. Many firms received temporary support during the pandemic, including through various forms of loan relief and tax breaks. Together with lower interest rates in 2020–22, this support contributed to a rebound in firm profitability and a lengthening of debt maturities.

2.2.2. The Rise of Zombies

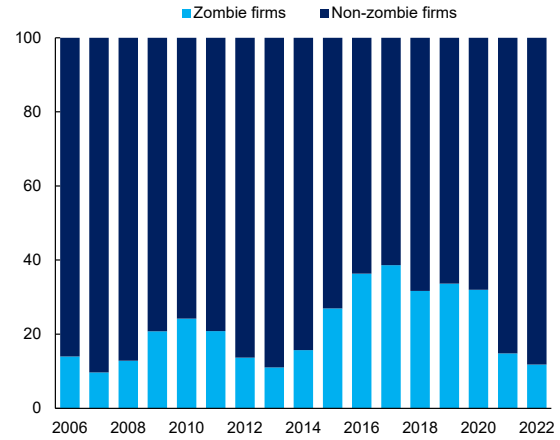
The analysis focuses on “zombie” firms—highly leveraged firms at a greater risk of default. Following Acharya and others (2022), we define zombie firms as those with an average ICR below 2.5 over two years that simultaneously receive “subsidized” lending (that is, their effective interest rate is below that of top-rated firms). The rationale for the ICR threshold of 2.5 is to focus on firms at the investment grade frontier, which, under stress conditions, are more likely to default. For robustness purposes, we adopt other definitions of zombie firms as well (see Annex I).

The share of zombie firms in the region—on an upward trend for over a decade—stood at about 12 percent in 2022 (Figure 3, panel 1). Moreover, zombie firms’ median leverage (proxied by total liabilities to total assets) was twice that of other firms at the end of 2022 (40 percent versus 20 percent) and, while non-zombie firms’ median profitability (proxied by return on assets) recovered after the pandemic, zombie firms’ operating losses continued to deteriorate. At the end of 2022, zombie firms held about 12 percent of corporate debt. Although this share is lower than pre-pandemic levels for a variety of reasons, including the bankruptcy of some firms and others receiving temporary support, history suggests that the share of debt held by zombie firms typically peaks several years after a recession.[6] About 10 percent of the zombie firms exited during the pandemic shock. Second, firms benefited from improved interest coverage ratios, reflecting pandemic-related government support such as interest payment moratoria and credit guarantees, in addition to a lower interest rate environment. Overall, before and after the pandemic, zombie firms are considerably less profitable, more leveraged, and have weaker cash buffers than healthy firms (Figure 3, panels 2–4), leading to a potential misallocation of resources.

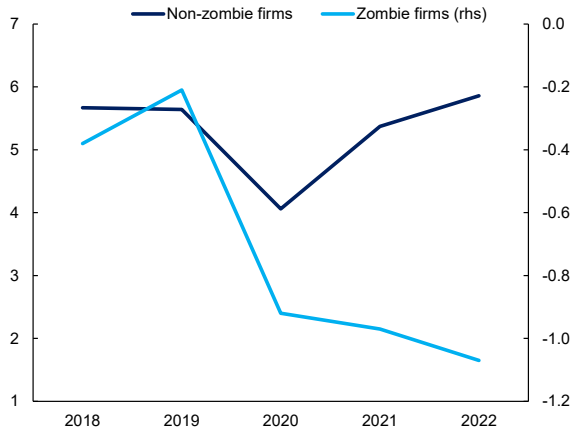
[6] Many firms received temporary support during the pandemic, including through various forms of loan relief and tax breaks. Together with lower interest rates over 2020–21, this contributed to temporarily higher ICRs for some zombie firms. While the total debt of firms in the sample declined between 2020 and 2021, the decline was more marked for zombie firms as some failed and went into bankruptcy and healthier firms were better able to access credit.

Figure 3. Zombie Firms

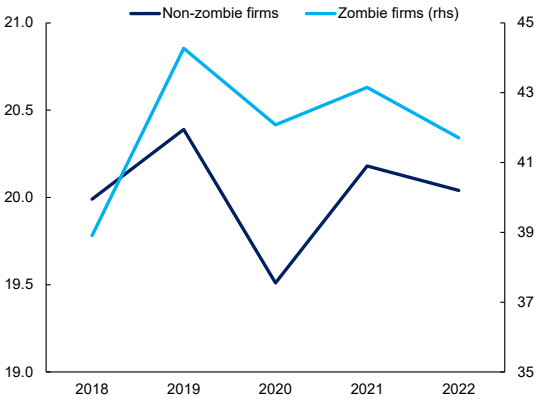
1. Corporate Debt Held by Zombie vs Non-zombie Firms
(Share of Total Debt)



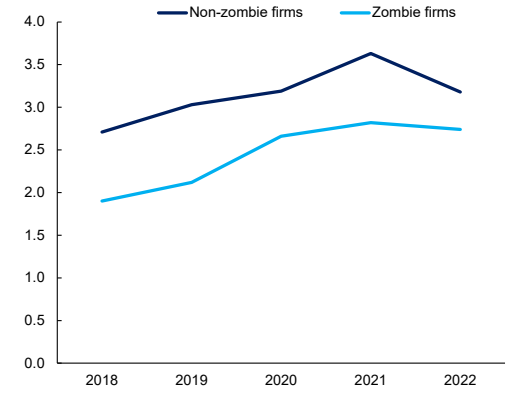
2. Corporate Sector: Median Return on Assets
(Ratio of EBIT to Total Assets, Percent)



3. Corporate Sector: Median Leverage Ratio
(Total Liabilities to Total Assets; Percent)



4. Corporate Sector: Median Cash Ratio
(Ratio of EBIT to Total Assets, Percent)



Sources: S&P Capital IQ; and IMF staff calculations.

Note: ICR = Interest coverage ratio; EBIT = Earnings before interest and taxes; Country coverage: AZE, BHR, EGY, JOR, KAZ, KGZ, KWT, LBN, MAR, OMN, PAK, QAT, SAU, SDN, TUN, and UAE.

2.3. Stylized Facts about MENA Banking Sectors

This section provides an overview of key indicators of the health of MENA banking systems, focusing on the recent time series, to give a snapshot of banks' buffers to withstand corporate sector stress and absorb liquidity pressures.

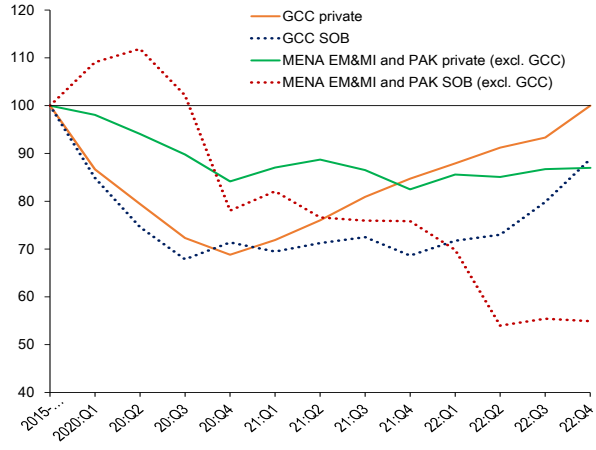
2.3.1. Capital Ratios and Profitability

MENA banks are well-capitalized and profitable despite some vulnerabilities among state-owned banks. Capital ratios across the region are well above regulatory minimums, even after the removal of most pandemic-related forbearance measures. Generally, bank profitability has recovered from pandemic lows. However, the business models of private versus state-owned banks show differentiation across profitability, credit quality, and capital buffers. The performance of state-owned banks remains well below pre-pandemic levels in non-GCC MENA economies and, to a lesser extent, in the GCC (Figure 4, panel 1), reflecting subsidized loan programs that lend

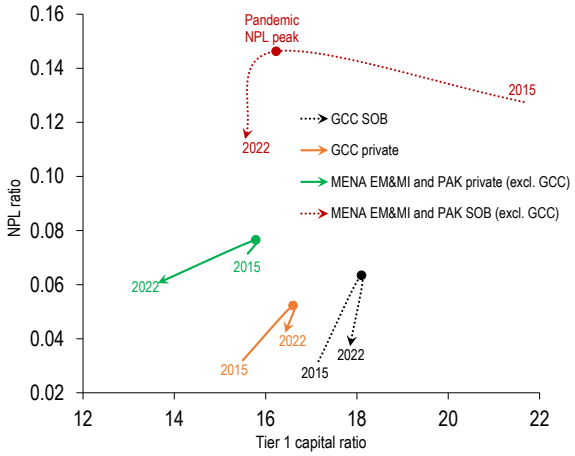
to state-owned enterprises or otherwise lend at preferential rates. Additionally, NPL ratios are elevated for state-owned banks in non-GCC MENAP countries because of a higher concentration of loans to less profitable state-owned enterprises (Figure 4, panel 2). Ultimately, banks could face a further deterioration in asset quality from interest-rate-sensitive borrowers that suddenly face challenges in servicing their debt in the higher-for-longer interest rate environment. This link will be quantified through the corporate sector stress test.

Figure 4. Banking Sector Buffers

1. Banking Sector Return on Assets (Median, index 100 = 2015-19 average)



2. Banking Sector Tier 1 Capital and NPL Ratios (Median, change from 2015-22)



Sources: Fitch Connect; Haver Analytics; and IMF staff calculations.

Note: State-owned banks are defined as banks with government ownership greater than 50 percent. Data labels in the figure use International Organization for Standardization (ISO) country codes. GCC = Gulf Cooperation Council; MENA EM&MI and PAK = Middle East and North Africa emerging market and middle-income countries and Pakistan; SOB = state-owned bank.

2.3.2. Funding Profiles

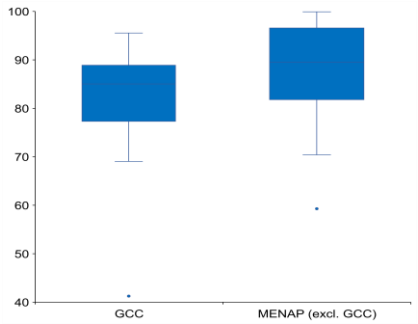
Deposits are the main funding source for banks in the region, while some GCC banks also rely on wholesale funding, such as repos (Figure 5, panel 1). For the median bank in the GCC, 85 percent of non-equity funding is through deposits or long-term debt (for example, bonds). In non-GCC MENA countries, this figure is 90 percent. Hence, risk-sensitive wholesale funding plays a limited role. However, high reliance on external funding, such as nonresident deposits and other foreign liabilities, increases banking sector vulnerability to sudden shifts in investor sentiment. For example, nonresident deposits could suddenly reverse during periods of stress or broader global financial turbulence, making outflows of such funding a source of volatility for banks in ME&CA. This is particularly relevant in countries with a larger dependence on external funding sources, such as in the GCC (Figure 5, panel 2).

Large deposit exposures bear the risk of sudden deposit withdrawals, potentially leading to a bank run. The risk of large deposit withdrawals may be mitigated by the large share of government deposits in the total deposit base in oil-exporting countries and government ownership of some major banks (for example, Egypt and Saudi Arabia). At the same time, formal deposit insurance varies widely across the region and is lacking in some countries (Figure 5, panel 3). In the median country, depositors are insured up to three times GDP per capita. Yet, at the fifth percentile of countries, less than 50 percent of GDP per capita is covered. As a result, some banks are vulnerable to large deposit withdrawals by uninsured depositors.

Figure 5. ME&CA Bank Funding Profiles

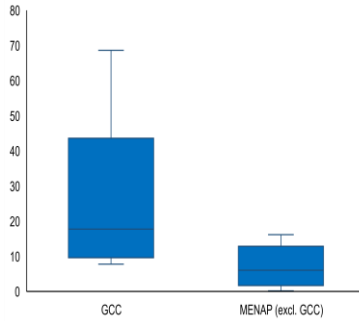
1. Share of Total Deposits and Long-term Funding

(By bank in region, percent of total liabilities, 2022)



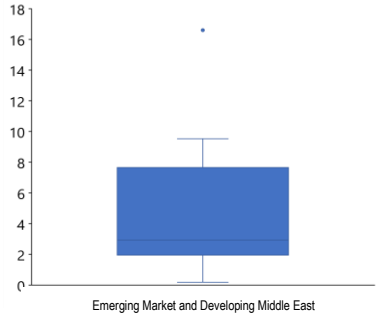
2. Banking Sector Foreign Liabilities

(Percent of total liabilities, 2022)



3. Deposit Insurance Coverage per Depositor per Institution

(Normalized by GDP per capita, 2022)



Sources: Fitch Connect; International Association of Deposit Insurers; and IMF staff calculations.

Note: Panel 2 shows country-level data for the banking sectors' nonresident liabilities as a percent of total liabilities, with countries grouped by subregion. The line in the middle of the boxes is the median, the outer edges of the boxes are the 25th and 75th percentiles, and the ends of the lines are the maximum and minimums. GCC = Gulf Cooperation Council; MENAP (excl GCC) = Middle East and North Africa, Afghanistan, (excluding GCC) and Pakistan.

2.3.3. Interest Rate Risk

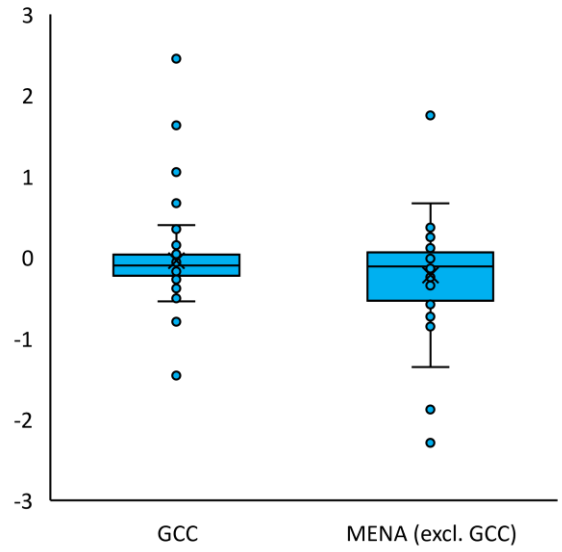
Rapid interest rate hikes since the beginning of 2022 in many MENA countries expose banks to interest rate risk as fixed-income securities on banks' balance sheets decline in value, exposing banks to capital losses. Figure 6, panel 1, computes banks' unrealized capital gains (or losses) as a share of banks' net income based on 2022 values.

Interest rate risk is high at some banks, as reported unrealized losses on available-for-sale securities exceed net income in some cases.[7] However, the share of unrealized gains/ losses as a fraction of capital looks appears manageable, meaning the impact from unrealized losses in a higher-for-longer interest rate environment looks manageable on average (Figure 6, panel 2). At the same time, some banks in the region may have also benefitted from rising interest rates over the last year, as net-interest income and margins expanded due to the positive impact of floating rate interest-earning assets.

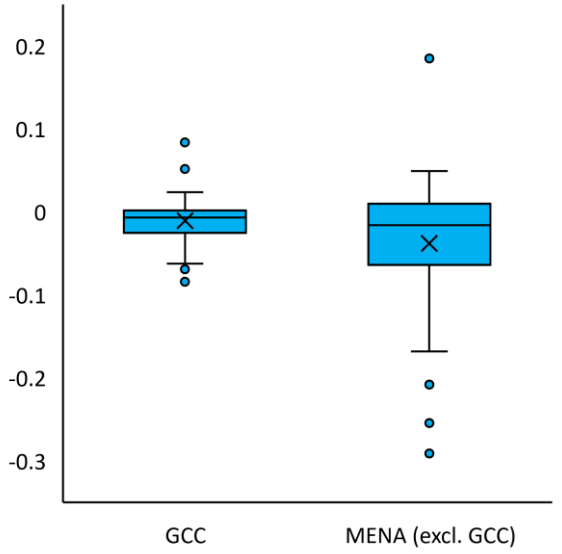
[7] Banks are required to mark available-for-sale securities to market. Hence, banks accumulate unrealized capital losses on these securities when interest rates rise. Those losses would be realized if assets were sold. Held-to-maturity securities are not marked-to-market and thus unrealized capital losses are not known ex-ante. In the banking sector stress test, we devise an algorithm to mark banks' assets to market, in particular held-to-maturity securities.

Figure 6. Bank Interest Rate Risk

1. Unrealized Capital Gains/Losses as a Share of Net Income (Percent, as of 2022)



2. Unrealized Capital Gains/Losses as a Share of Tier-1 Capital (Percent, as of 2022)



Sources: Fitch Connect; IMF staff calculations.

Notes: GCC = Gulf Cooperation Council; MENA = Middle East and North Africa.

2.3.4. Bank-Sovereign Nexus

In banking systems with elevated bank holdings of domestic sovereign debt, high government exposure to interest rate risk and worsening sovereign credit conditions could spill over to banks. As in other regions in the world (Deghi and others 2022), the sovereign-bank nexus has been rising in MENA over the past years with banking sector claims on the public sector (Figure 7, panel 1) ranging between 10 and 30 percent of banking sector assets in most other MENA countries, while exceeding 50 percent of banking sector assets in some countries (Egypt, Pakistan). This elevated bank-sovereign nexus has several potential banking sector implications.

First, it may leave banks vulnerable to a further tightening in financial conditions that may erode capital and liquidity positions, particularly if marking-to-market and the sale of government debt is needed to combat funding stress. Since a large share of government bonds are held-to-maturity given the relatively illiquid secondary markets in the region, a large share of government bonds is not market-to-market. Hence, banks would realize potentially large capital losses when selling those bonds in a higher interest rate environment. Moreover, fire sale externalities, especially in illiquid markets, may further depress the value of these bonds in the event of a liquidity shock.

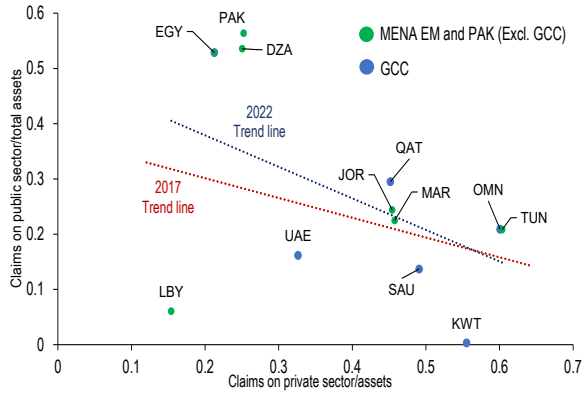
Second, capital ratios may be inflated due to the zero-risk weight on domestic government bond holdings. While risk-based Tier-1 capital ratios are comfortably above Basel-III regulatory minima in all countries in the region (see Figure 4, panel 2), the simple leverage ratio computed as equity as a fraction of assets is particularly low in those countries with an elevated bank-sovereign nexus as evidenced by the negative correlation between Equity/Assets and the share of banking sector claims on the public sector in Figure 7, panel 2. Hence, risk-based

capital ratios paint an incomplete picture of banking sector health in countries with an elevated bank-sovereign nexus.

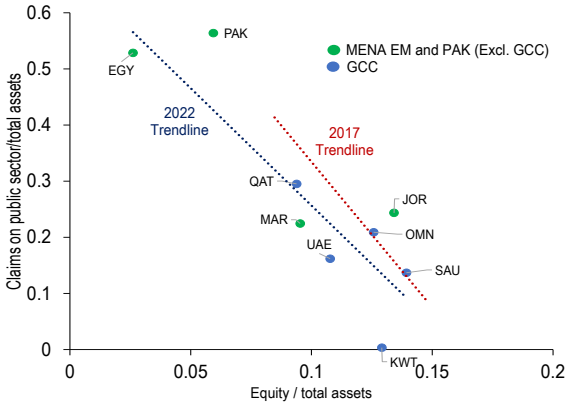
Third, the elevated bank-sovereign nexus implies that banks may not fund other activities. Figure 7, panel 1, shows that the share of banking sector claims on the public sector negatively correlates with the share claims on the private sector, suggesting that an elevated bank-sovereign nexus may crowd out private sector credit resulting in a macroeconomic opportunity cost in terms of low private sector credit and low growth. Finally, in countries that are already facing elevated gross financing needs, higher sovereign borrowing costs could fuel debt sustainability concerns and limit access to international financing sources.

Figure 7. Sovereign-Bank Nexus

1. Bank Exposures to Sovereign Debt and Private-Sector Credit (Share of total assets, dots are as of 2022)



2. Bank Exposure to Sovereign Debt and Banking Sector Leverage (Share of total assets, dots are as of 2022)



Sources: Fitch Connect; Haver Analytics; and IMF staff calculations.

Note: Some countries are excluded due to missing bank-level data; dots for 2017 are not shown (only the accompanying trend line). A steepening of the trend line over time indicates a strengthening of the sovereign-bank nexus. Data labels in the figure use International Organization for Standardization (ISO) country codes. GCC = Gulf Cooperation Council; MENA EM and PAK = Middle East and North Africa emerging market countries and Pakistan.

3. Corporate Sector Stress Test

3.1. Methodology

The adverse scenario is calibrated to a higher-for-longer interest rate environment combined with a sector-specific profitability shock, allowing us to simulate the impact of a global slowdown.[8]

First, the effective interest rate is assumed to increase homogenously for each firm by 100 bps per year (the "higher-for-longer" hypothesis) over 2023–24, a similar increase to that seen across firms following the Global Financial Crisis (GFC). In particular, the effective interest rate is sequentially increased from about 6 percent at the end of 2022 by 100 basis points per year, reaching an average of more than 8 percent by the end of 2024, or 2 percentage points higher than pre-pandemic levels.

[8] This analysis focuses primarily on the direct effects of higher-for-longer interest rates. However, by considering a global slowdown shock and two consecutive years (2023–24) in the simulation exercise, the exercise implicitly accounts for second-round effects—the feedback effects between the corporate and banking sectors.

Second, a global slowdown shock is simulated through a sector-specific EBIT (earnings before interest and taxes) shock, which is applied individually to each firm. The EBIT shock was calibrated based on the observed changes in profitability during and after the GFC (that is, in 2009 and 2010) for each sector. In each simulation round, a sector-specific random return is drawn for each firm. The sector-specific profitability shocks are calibrated based on the evolution of earnings (before taxes and interest) in the first two years after the Global Financial Crisis, with most sectors experiencing double-digit negative returns.[9] For each firm *i* in sector *s*, change in profits is given by:

$$EBIT_{ist+1} = EBIT_{ist} * (1 + \pi_{ist+1}) \quad (1)$$

where π_{ist+1} is the change in firm profitability drawn from a sector-specific distribution.[10]

3.2. Results

The corporate stress test results show that firm profitability could decline, on average, to about 3 percent in 2024, below the pre-pandemic level of 5 percent. At the same time, the median ICR is estimated to decline from 3.5 to 1.5 at the end of 2024, and the share of debt at risk of default more than doubles, rising from about 12 percent of total debt in 2022 to almost 30 percent by 2024 (Figure 8, panel 1).[11] Firms in the transportation, capital goods, and food and beverage sectors would be most vulnerable, with the median share of zombie firm debt in the food and beverages sector increasing particularly sharply by 2024 (Figure 8, panel 2).

[9] An alternative scenario is simulated as a robustness check in which the sector-specific profitability shock is calibrated following the 2014–15 oil price shock (see Annex I). In this scenario, sectors more sensitive to lower oil prices (for example, energy) are associated with more negative returns while others benefit (for example, transportation). Under the alternative stress scenario, the share of zombie-held debt increases to 25 percent of total debt by 2024. Transportation and food and beverages remain the sectors most sensitive to the interest rate shock in the alternative scenario.

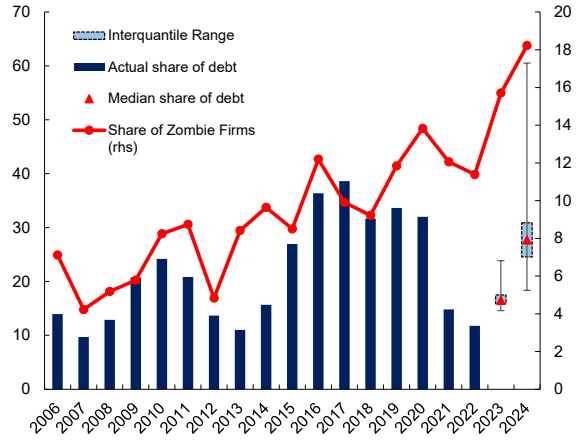
[10] Details on the calibration of the sector-specific distributions are outlined in Annex 1.

[11] Beyond the direct impact of the interest rate increase, zombification may further due to indirect channels as discussed in Albuquerque and Mao (2023).

Figure 8. Corporate Debt at Risk

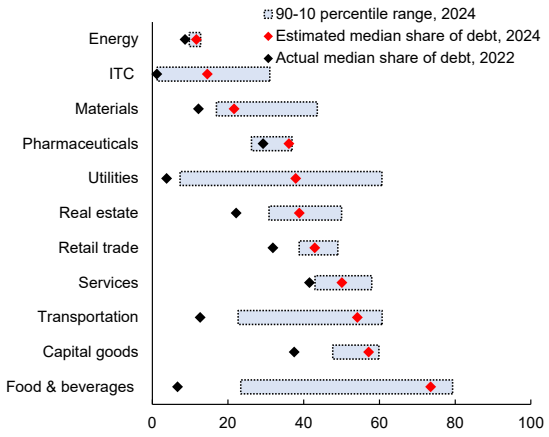
1. Corporate Debt Held by Zombie Firms

(Percent of total debt; simulation results for 2023–24)



2. Share of Debt Held at Zombie Firms by Sector

(Percent of total debt; simulation results for 2024)



Sources: S&P Capital IQ; and IMF staff calculations.

Note: ICR = Interest Coverage Ratio; EBIT = Earnings before interest and taxes; Country coverage: AZE, BHR, EGY, JOR, KAZ, KGZ, KWT, LBN, MAR, OMN, PAK, QAT, SAU, SDN, TUN, and UAE.

Under the alternative stress scenario, the share of zombie-held debt increases to 25 percent of total debt by 2024. Transportation and food and beverages remain the sectors most sensitive to the interest rate shock in the alternative scenario.

4. Banking Sector Stress Test

Liquidity shocks and borrower distress could test banking sectors in the MENA region, with the impact of these shocks depending on the level of the interest rate. This section conducts a banking sector stress test with liquidity and credit shocks, with results differentiated by the level of the interest rate. The stress test proceeds in three steps. First, we estimate the sensitivity of bank profitability to interest rate changes. This step quantifies the impact of higher-for-longer interest rates on bank profitability. Second, we simulate a liquidity shock through the sudden withdrawal of deposits and non-deposit funding. Third, we map the corporate sector stress scenarios from the previous section into increasing NPLs and simulate the impact of corporate sector stress on banks' balance sheets. Our main exercise will include joint liquidity and corporate sector stress amid higher interest rates. To better understand the drivers of this joint scenario, we also consider liquidity and corporate sector stress in isolation.

4.1. Methodology

Our methodology relies on bank-level microdata, particularly bank balance sheets and income statements. While aggregate indicators of banking sector health are useful for monitoring banking sector vulnerabilities, microdata are critical for our stress test since aggregate indicators may mask the vulnerabilities of individual institutions. Indeed, our stress test results will show substantial heterogeneity in banks' vulnerability to a higher-for-longer scenario within the same country.

4.1.1. Estimating Impact of Higher Interest Rates on Bank Profitability

Theoretically, the effect of higher interest rates on bank profitability is ambiguous. Banks whose cost of funding is relatively insensitive to policy rates may see increasing profitability, especially if their assets reprice quickly. At the other extreme, banks with a high share of fixed rates loans and hence a low "income beta" (Drechsler and others 2021) could witness a decline in profitability, especially if they have a high "expense beta." To formally estimate banks' sensitivity to higher interest rates, we estimate bank-level income and expense betas and RoA betas based on the framework by Drechsler and others (2021) adapted to our sample of 10 MENA countries. RoA betas measure the sensitivity of banks' profitability, measured as return on assets, to an increase in the policy rate. Our estimating equation is:

$$\Delta RoA_{it} = \alpha_i + \gamma_{c,t} + \sum_{\tau=0}^{3} \beta_{i,\tau}^{RoA} \Delta Policy\ Rate_{t-\tau} + \varepsilon_{it} \quad (2)$$

ΔRoA_{it} is the first difference in bank i's return on assets. α_i is a bank fixed effect that captures bank-specific time-invariant factors and ensures that our betas are identified only from within-bank variation. $\gamma_{c,t}$ is a country-time fixed effect that captures country-time-specific factors, in particular macro variables beyond the policy rate. Our main object of interest is the series of coefficients $\beta_{i,\tau}^{RoA}$. Following Drechsler and others (2021), we define the RoA beta as $\beta_i^{RoA} = \sum_{\tau=0}^{3} \beta_{i,\tau}^{RoA}$. RoA is defined as quarterly net income divided by total assets. To account for cyclicality in RoA, we use the average of RoA over the last four quarters.[12] Income betas are computed using the first difference of total interest income divided by quarterly assets. Expense betas are computed from the analogous ratio with total interest expenses in the numerator. For the estimation, we only include banks with at least 40 quarterly observations of the respective outcome variable. This ensures a sufficiently long time series to estimate betas relatively precisely by including years before the zero lower bound period.[13]

Annex 2 details the estimation results. While many banks tend to benefit on average from higher rates, about one-third of banks have a negative RoA beta. Hence, higher interest rates affect those banks adversely. To mitigate concerns about endogeneity in equation (2) and further validate the estimated RoA betas, we compute the correlation of bank-level RoA betas with several bank characteristics. Annex 2 shows that banks with lower NPL ratios, more held-to-maturity securities, a lower share of wholesale funding, or higher capital ratios have, on average, higher RoA betas. Thus, our estimated RoA betas correlate intuitively with several drivers of bank profitability.[14]

The mean RoA beta is 0.097, with a standard deviation of 0.37. This heterogeneity in the response of profitability to higher interest rates makes it crucial to account for the impact of higher rates on bank profitability in the stress test scenarios. For some banks, the "endogenous" response of profitability to higher interest rates will increase their buffers but others will become more vulnerable due to higher interest rates even without any additional stress scenario, particularly banks with a high share of fixed rates loans or a high share of liabilities that reprice.

For some banks in the sample, the data coverage is below the required 40 quarters to estimate bank-level betas. Estimating betas for these banks would likely lead to imprecise estimates and be biased by the prolonged zero

[12] See also Drechsler and others (2021).

[13] Some countries in the sample (for example, Bahrain, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) have pegs against the US dollar and follow US monetary policy decisions closely.

[14] Unfortunately, our data does not contain data on the share of variable rate loans, so we cannot directly test the prediction that banks with more variable rate loans should have higher RoA betas.

lower bound period in the United States, which implies no changes in policy rates for an extended period in those countries with a US dollar peg. Instead, for these banks we assume their beta corresponds to a weighted average of betas estimated for other banks within the same country.

4.1.2. Simulating liquidity shocks

The liquidity stress test builds on the methodology of Copestake and others (2023) and Jiang and others (2023). It simulates how banks would meet a sudden deposit withdrawal—the liquidity shock—and computes the resulting losses if banks realized capital losses on the sales of securities that are not yet market-to-market. Consequently, there are two key inputs to the liquidity stress test: the size of the deposit withdrawal and an algorithm to mark-to-market banks' assets.

For the size of the liquidity shock, we consider a withdrawal of 20 percent of deposits, comparable to the moderate scenario in Copestake and others (2023), the magnitudes simulated in the IMF's Financial Sector Assessment Programs (for example, IMF 2021, IMF 2023b), and the withdrawal suffered by Silicon Valley Bank in the United States on March 9, 2023.[15] To capture the higher risk of outflows from wholesale funding and foreign currency deposits, we assume that these funding types have a 30 percent outflow rate. The combined bank-specific deposit outflow $Withdrawal_b$ is given by:

$$Withdrawal_b = .2\ LC\ Deposits_b + .3(FX\ Deposits_b + Wholesale\ Funding_b) \quad (3)$$

To meet withdrawals, banks will need to liquidate assets. We conservatively assume that banks first use their pre-existing cash buffers. If deposit withdrawals exceed existing cash buffers, banks would have to sell parts of their securities portfolio. Government securities, the most liquid in MENA countries, are assumed to be the first assets sold before any other securities. Finally, if outflows still cannot be covered, loans would be sold. Throughout, we distinguish between available-for-sale securities that are already marked-to-market and held-to-maturity securities, which would lead to the realization of previously not accounted-for capital losses.[16] We base our valuation assumptions on the increase in interest rates and the changes in sovereign spreads since early 2022.

Banks use the following pecking order for assets to meet withdrawals. First, banks exhaust existing cash buffers without any asset sales. Second, if needed, banks sell government bonds that are already marked-to-market. Third, banks sell government bonds that are not yet market-to-market. Fourth, they sell other securities; fifth, they sell illiquid assets like loans.

The liquidity stress-test methodology[17] involves three steps. First, we mark banks' sovereign bond and other securities holdings to market. Second, we use scenarios (discussed above) to determine the extent of deposit withdrawals and the size of asset sales required to meet these withdrawals. Third, we scale the resulting realized losses by regulatory capital. Annex 3 includes methodological details based on those of Copestake and others (2023) and Jiang and others (2023).

Annex 3 outlines the algorithm used to compute the size of losses banks would accumulate under the withdrawal shock outlined in equation (3). We make two additional important assumptions. First, like Copestake and others

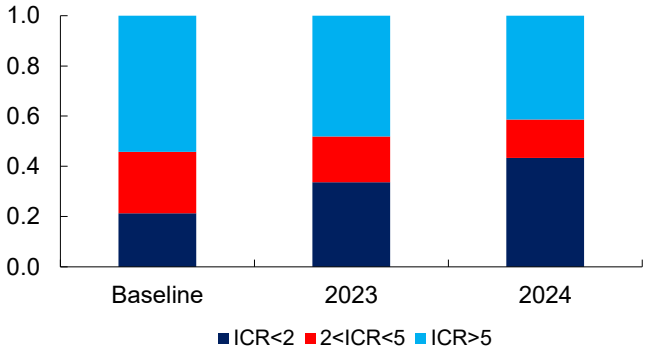
[15] Silicon Valley Bank suffered an outflow of over $40 billion on March 9, 2023, amounting to 25 percent of total deposits (Federal Reserve Board 2023).
[16] For most banks, data on the breakdown between available-for-sale (afs) and held-to-maturity (htm) securities is available. For banks where this information is missing, we impute the share of afs securities using the average country-level share.
[17] Methodology developed by Copestake and others (2023) and adopted here with changes to MENA countries.

(2023), we assume that banks incur an additional 30 percent discount if they need to sell loans or another illiquid asset to meet deposit withdrawals. This captures the fact that selling illiquid assets incurs larger costs (Elkamhi and Nozawa, 2022) due to information asymmetries and the non-existence of markets to transact those assets. Second, we simulate fire sale discounts for securities to capture the fact that even unwinding large positions of liquid assets in times of banking sector stress may require a discount.[18] Concretely, we simulate 1,000 draws of a fire sale discount from a distribution calibrated to the increase in sovereign spreads in 2020 during the Covid crisis (details are provided in Annex 3). For simplicity of exposition, we focus on reporting results for the median draw in the next section.

4.1.3. Credit Stress

The credit stress scenario builds on the corporate sector stress test from section 3. Using the simulated results from the corporate sector stress test for 2024 (when the peak impact occurs in the corporate sector), we compute the distribution of ICRs in the corporate sector under the 2022 baseline and the adverse scenario for 2024. Higher interest rates and lower profitability lead to a decrease in ICRs. The deterioration of ICRs (Figure 9) is mapped into changes in probabilities of default using the mapping from Damodaran (2023). This implies an increase in NPLs of 2.1 percent of net loans for 2023 and 2.7 percent for 2024. It is assumed that banks provision 100 percent against the increase in NPLs.[19] Increases in provisioning adversely affect net income in the credit stress scenario and the combined credit and liquidity stress test.

Figure 9. Corporate Debt Share by ICR



Sources: Capital IQ; and IMF staff calculations.
Note: Figure reports distribution of interest coverage ratios across firms (weighted by debt) for 2022 baseline, 2023 and 2024 scenarios. The 2023 scenario assumes a negative shock to EBIT consistent with first year of the global financial crisis and 100 basis points higher interest rates. The 2024 scenario assumes an EBIT shock consistent with the second year of the global financial crisis and an additional 100 basis points increase in interest rates.

4.1.4. Summary of Scenarios

In sum, we consider the following four scenarios:

1. Liquidity stress: A 20 percent deposit withdrawal with a stronger withdrawal (30 percent) of foreign deposits and wholesale funding.
2. Liquidity stress amid higher interest rates: A 20 percent deposit withdrawal with a stronger withdrawal (30 percent) of foreign deposits and wholesale funding amid 200 basis points higher interest rates that lead to capital losses on fixed income assets.
3. Credit stress: A rise in corporate sector NPLs consistent with the corporate sector stress test in section 3 with increasing NPLs 100 percent provisioned for.
4. Combined liquidity and credit stress amid higher interest rates: A combination of scenarios 2 and 3 with a liquidity shock, higher interest rates, and credit stress.

[18] For example, during March 2020, even AAA-rated corporate bonds traded at significant discounts (Haddad and others 2021).
[19] For Kuwait, where provisioning ratios currently exceed 200 percent for some banks, we assume that banks increase their provisions by the minimum of the increase in NPLs and the amount needed to maintain a provisioning ratio of at least 150 percent.

Our stress testing methodology and scenario design have three distinct advantages. First, we make all calculations using publicly available data rather than confidential data from central banks.[20] Second, we focus on common scenarios across countries, which has the advantage of facilitating cross-country comparisons within the MENA region. Third, because of the two first points, our results are easy to replicate, can be updated quickly, and can be adapted to incorporate alternative modeling assumptions. This is a unique advantage of our methodology relative to the stress tests conducted internally by central banks, which rely on more granular data but whose assumptions cannot easily be altered by outsiders.

These advantages come at the expense of several strong assumptions. While we take a regional approach with common scenarios across banks in the region, it may be of interest to other users to use country-specific scenarios instead. This can easily be incorporated into our methodology. Likewise, data on hedging of interest rate risks could be incorporated if available. Our implicit assumption is that banks are unhedged to interest rate risk on their held-to-maturity securities portfolios. Moreover, our concepts of solvency and liquidity are based on the academic literature, which differ from those used by regulators. Throughout, we do not model any second-round effects or systemic contagion. These have been shown in the literature to be important forces that amplify individual bank distress (for example, Elliott and others 2014, Longstaff 2010). The mapping from corporate sector ICRs into implied probabilities of default from Damodaran (2023) is based on US data (a regional mapping was not available). Finally, due to the absence of recent liquidity stress episodes in the region,[21] uncertainty about how such episodes would play out is high. While we model the impact of fire sales stochastically, outcomes may differ depending on market sentiment and regulatory interventions.

4.2. Results

Figure 10 reports the banking sector stress test results across the different scenarios. While the banking systems in most countries could withstand isolated liquidity or corporate sector stress amid higher interest rates, a combined scenario of higher rates, corporate sector stress, and liquidity stress could stress the banking systems in the region, particularly non-GCC countries. Stress test losses are low on average in the GCC, reflecting high profitability, low duration risk in some countries (for example, the United Arab Emirates), and an elevated share of already marked-to-market securities. Losses for banks in non-GCC MENA countries (Egypt, Jordan, Morocco, Pakistan) are larger on average than for GCC countries, reflecting lower profitability, lower capital ratios, and a large bank-sovereign nexus.

Quantitatively, losses in the GCC range from 0.3 percent of capital in the isolated liquidity stress scenario to 13.4 percent of Tier-1 capital in the combined stress scenario. Despite the heterogeneity in losses, bank capitalization across all banking systems in the GCC would remain comfortably above regulatory minima. In the combined shock scenario, the weighted average Tier-1 capital ratio in the GCC would drop from 17.1 percent to

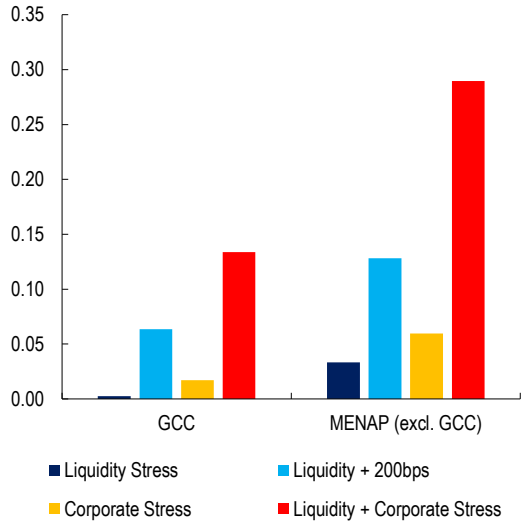
[20] In practice, stress testing for credit stress is often conducted using confidential data from credit registries, for example.

[21] For example, the largest withdrawal event in Jordan (see IMF 2021) was a 3 percent withdrawal during the Arab Spring.

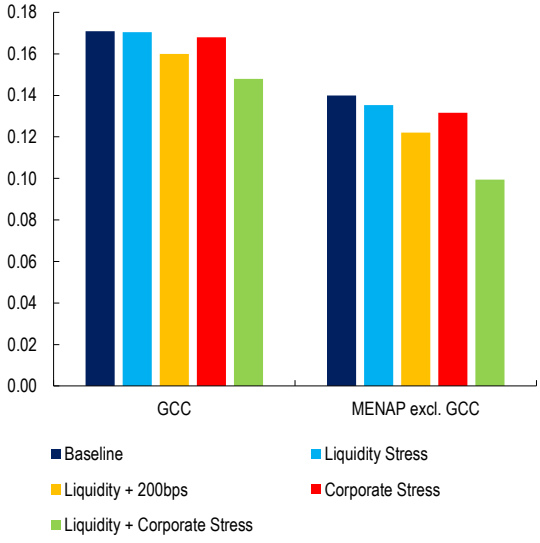
14.8 percent, significantly above Basel-III regulatory minima of 8.5 percent.[22] For non-GCC MENA countries, capital ratios would decline from their current level of 14 percent to 10 percent.

Figure 10. Bank Stress Test Results

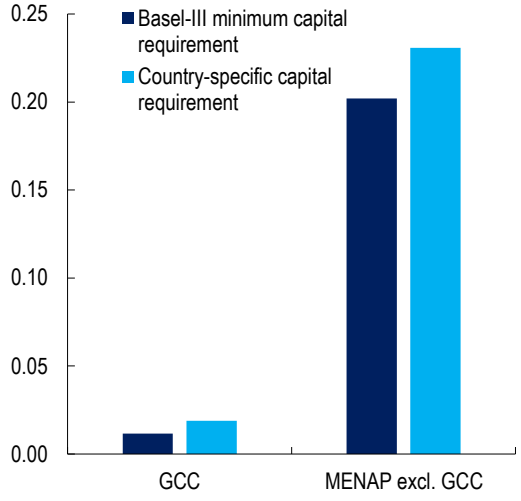
1. Losses as a fraction of Tier-1 Capital
(Losses/ Tier-1 Capital)



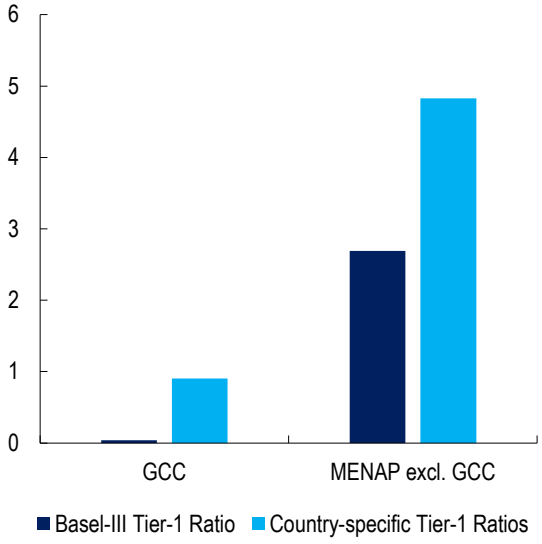
2. Counterfactual Tier-1 Capital Ratios
(Tier-1 Capital/RWA across scenarios)



3. Share of Banks that would become undercapitalized
(Share of total, weighted by assets)



4. Refinancing Needs
(Billion USD)



[22] CET-1 regulatory minima stand at 4.5 percent; additional tier-1 capital of 1.5 percent is required. Moreover, all countries in the sample operate a capital conservation buffer (CCB) which usually stands at 2.5 percent. Adding up those requirements yields an 8.5 percent minimum Tier-1 capital requirement. In some countries, the CCB was temporarily lowered during the pandemic and as of November 2023, the reduction has not yet been reversed (for example, the CCB in Oman still stands at 1.25 percent, below its 2.5 percent normal level). Several countries in the region also impose higher minimum capital requirements than Basel-III. This is discussed below.

Sources: Fitch Connect, Bloomberg L.P.; and IMF staff calculations.

Notes: Panel 1 reports losses as a fraction of Tier-1 capital across subregions. Panel 2 reports counterfactual Tier-1 capital ratios under losses from panel 1. Panel 3 shows the share of banks that would become undercapitalized across regions, weighted by assets. Panel 4 shows the implied refinancing needs if all banks that are undercapitalized in panel 3 are re-capitalized as to meet their respective minimum capital requirement. GCC includes Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. MENAP excl. GCC is Middle East and North Africa, Afghanistan, and Pakistan excluding the GCC. Countries covered are Egypt, Jordan, Morocco, and Pakistan.

Throughout the analysis, losses in the combined scenario exceed the sum of the losses under the individual scenarios (liquidity stress and corporate sector stress, respectively). The main reason is that bank buffers can only be deployed once. A profitable bank may be able to absorb either capital losses from selling hold-to-maturity assets after a liquidity shock or absorb higher provisioning needs in case of corporate sector stress. However, if both shocks occur simultaneously, the profitability buffer is insufficient in many cases, implying that bank capital is adversely affected. For example, banks in MENA (excluding the GCC) would suffer losses of 12.8 percent of Tier-1 capital in the case of a liquidity shock under higher interest rates, and a 6 percent shock in the case of isolated corporate sector stress. However, in the combined scenario of liquidity and corporate sector stress amid higher interest rates, losses would amount to 29 percent—greater than the sum of losses under the isolated liquidity stress and corporate sector stress scenarios.

To further assess the macrofinancial implications and the extent of recapitalization needs for banks, we compute the share of banks that fall below minimum capital requirements. As discussed previously, we use 8.5 percent as the Basel-III minimum Tier-1 capital requirement (including the CCB). As a second criterion for under-capitalization, we use country-specific Tier-1 capital requirements, which are higher than Basel-III minima in several countries in our sample. Throughout, domestic systemically important banks' surcharges and other buffers are treated as buffers and not as capital requirements in line with recent IMF Financial Sector Assessment Programs (for example, IMF 2023a).

The share of undercapitalized banks in the GCC would be modest, while a sizable share of banks (weighted by size) in non-GCC MENA countries and Pakistan would become undercapitalized (Figure 10, panel 3). Overall, 1.2 percent of GCC banks (weighted by assets) would become undercapitalized in the most severe scenario when imposing the Basel-III minimum capital requirements. This share rises only slightly to 1.9 percent when using country-specific minima, which are higher than Basel-III minima in all GCC countries. In MENA countries (excluding the GCC) and Pakistan, 20.2 percent of banks (23.1 percent when using country-specific capital requirements) would become undercapitalized, reflecting the lower buffers and greater ex-ante vulnerability of banks in that region.

Finally, we compute the recapitalization needs if all banks that become undercapitalized in the most stringent scenario are recapitalized to the level of meeting their minimum Tier-1 capital requirement (Figure 10, panel 4). Since only a few isolated small banks in the GCC would become undercapitalized, the total recapitalization needs amount to only $0.9 billion in the most severe scenario and imposing country-specific Tier-1 capital minima. In non-GCC MENA, bank recapitalization would require $4.8 billion. While the potential cost of bank recapitalization in a stress scenario is modest for the GCC, a decline in bank capital in a stress scenario (Figure 9, panel 2) could affect credit provision, even when banks remain adequately capitalized as discussed below.

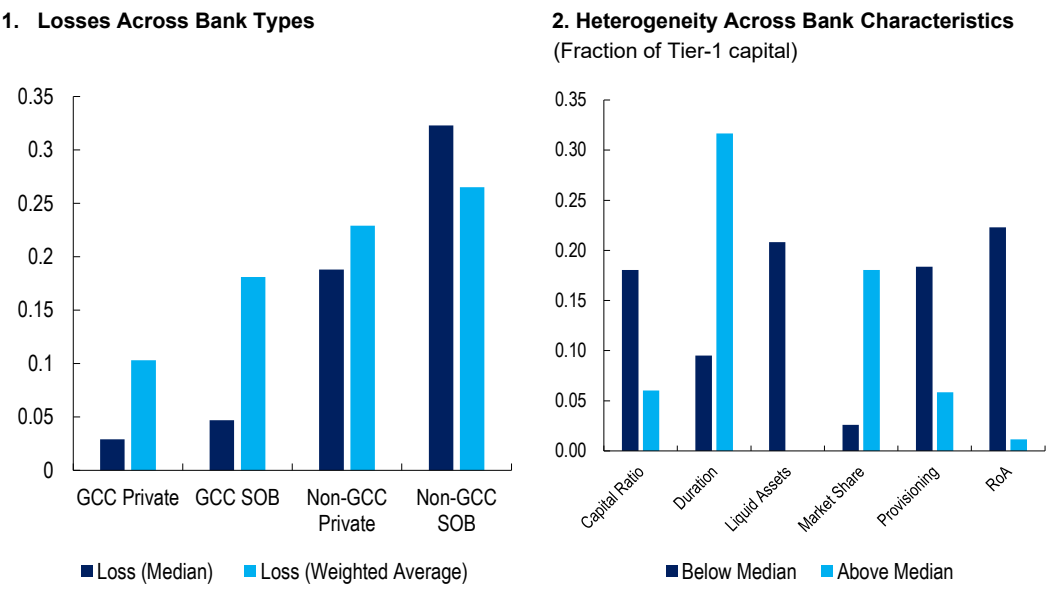
4.3. Heterogeneity Analysis

To further understand the drivers of banking system vulnerability to higher-for-longer interest rates in the region, we turn to a bank-level analysis. First, we focus on the role of state-owned banks; then we investigate other drivers of vulnerability.

4.3.1. The Role of State-owned Banks

State-owned banks may be particularly vulnerable to banking sector stress in a higher-for-longer interest rate scenario because of their slower recovery from the pandemic (see Figure 4) and greater exposure to interest-rate-sensitive fixed-income securities, particularly government bonds.

Figure 11. Heterogeneity Analysis



Sources: Fitch Connect, Bloomberg L.P.; and IMF staff calculations.

Notes: Panel 1 reports median losses across country groups separating privately owned and state-owned banks (SOBs). Panel 2 splits the cross-section of banks along the median for several characteristics (capital ratio, duration of outstanding government bonds, liquid assets, market share, provisioning ratio, return on assets (RoA), and then reports losses as a fraction of Tier-1 capital for the respective bank groupings.

Throughout, losses for state-owned banks are larger than for privately owned ones, both in the GCC and outside the GCC. Figure 11, panel 1, shows the breakdown of bank-level losses separated between privately owned and state-owned banks where state-owned banks are defined as banks with at least 50 percent government ownership.[23] To account for the strong skewness in the within-country size distribution of banks, we compute weighted averages using the within-country market share of banks as weights.

Across both subregions, state-owned banks are more vulnerable than privately-owned banks. The weighted average loss of privately owned banks in the GCC is 10.3 percent of capital, compared to 18.1 percent for state-owned banks reflecting their lower profitability and greater exposure to duration risk through holdings of held-to-maturity securities. In MENA (excluding the GCC) and Pakistan, privately owned banks suffer on average a 22.9

[23] Government ownership comprises both direct ownership by the central government and indirect ownership through financing vehicles of the central government.

percent loss, relative to 26.5 percent for state-owned banks, again emphasizing the greater vulnerability of state-owned banks.

4.3.2. The Role of Ex-Ante Vulnerabilities

To further understand the main drivers of bank vulnerability, we split bank-level losses across the cross-section of banks along several characteristics. Figure 11, panel 2, splits banks along the median across several characteristics. Ex-ante more vulnerable banks consistently have higher losses in the joint stress scenario. For instance, the average loss for banks with below-median capitalization (measured using the Tier-1 Capital Ratio) stands at 18 percent of capital, relative to 6 percent for banks with above median capitalization. Similarly, losses are concentrated in banks with below median holdings of liquid assets, with lower ex-ante provisioning, and weak profitability. To assess the impact of (unhedged) duration risk, a key driver in the US banking sector turmoil in March 2023 (Jiang and others 2023; McPhail and others 2023), we need to rely on country-level measures of duration risk. Losses for banks in countries with low duration risk are on average 9 percent, compared to 32 percent for banks in countries with above-median duration. Finally, we find that losses are more concentrated in larger banks, defined as banks with above-median market share. Those banks have on average losses of 18 percent of capital. Hence, several potentially systemic banks in the relatively concentrated MENA banking systems (Chaffai and Coccorese 2023) display sizable losses in the combined stress scenario mirroring the notable decline in capital ratios in many countries in the combined scenario in Figure 9, Panel 2.

5. Impact on Credit and Output

While few banks would become undercapitalized in the stress scenarios of section 4, bank capital would decline markedly across countries in the region as banks realize previously unrealized capital losses in the event of liquidity shocks and are tested by corporate sector stress. A large body of literature shows how negative shocks to bank capital adversely affect lending (for example, Acharya and others 2018; Blattner and others 2023; Greenwald and others 2023). In this section, we quantify the potential impact of declining capital on lending using panel data and a local projections approach. Building on these micro-level estimates, we then estimate the aggregate impact of the implied credit contraction on output using a macroeconometric model.

5.1. Bank-level Relationship Between Capital and Lending

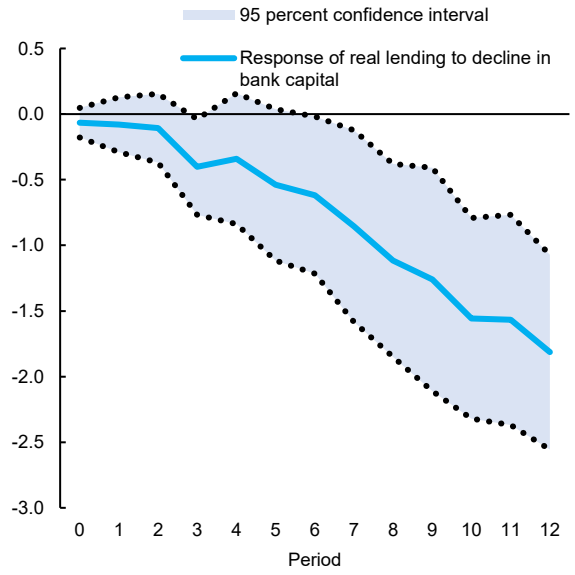
To quantify the relationship between bank capital and lending, we estimate the following local projections (Jordà 2005) specification on the quarterly bank-level panel data for horizons h = 0,1, 2,…,12:

$$\Delta y_{i,t+h-1} = \alpha_i^h + \alpha_{c,t}^h + \alpha_q^h + \beta^h CR_{i,t-1} + \gamma^h X_{i,t-1} + \varepsilon_{i,t+h} \quad (4)$$

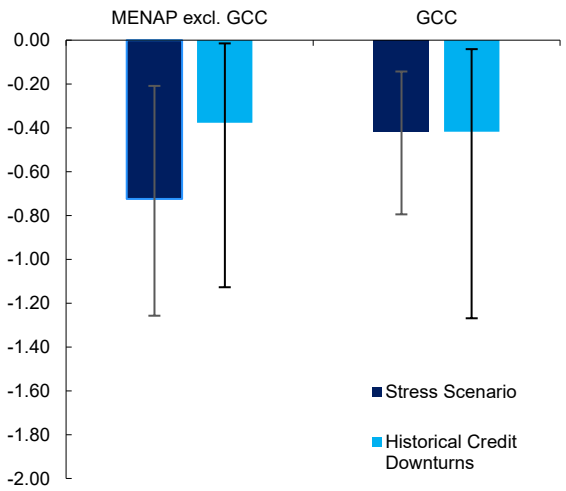
$\Delta y_{i,t+h-1}$ is the growth rate of real lending at bank i from time $t-1$ to time t+h, measured as the log difference of real lending. α_i^h is a bank fixed effect that absorbs time-invariant bank-level factors. $CR_{i,t-1}$ is the lagged Tier-1 capital ratio of bank i. $X_{i,t-1}$ captures other (lagged) bank-level controls, notably the share of liquid assets and the NPL ratio. $\alpha_{c,t}^h$ are country-time fixed effects that absorb any macroeconomic variables at the country-time level such as growth, changes in policy rates, changes in oil prices, and global financial conditions. Finally, α_q^h are quarter-of-the-year fixed effects that address potential seasonality. We estimate equation (4) on quarterly bank-level data for the 10 countries in the stress test covering the 2010–22 period.

Figure 12. Macrofinancial Linkages

1. Bank Capital and Lending
(Effect of 1 ppt lower capital ratio on real credit, percent)



2. Effect of Real Credit Contractions on Real Output
(Percent)



Sources: Fitch Connect; Haver Analytics; and IMF staff calculations.
Note: Panel 1 reports estimated impulse response of real credit to lower bank capital ratios. Standard errors are double-clustered by bank and time. Dotted lines display 95 percent confidence bands. Panel 2 reports distribution of output losses from credit contractions under stress scenarios (blue plot) and during historical credit downturns (red plot). The output losses displayed reflect the median and 95th percentile of losses across countries in each subregion (estimation details in Annex IV).

Figure 12, panel 1, displays the estimated series of coefficients β^h for up to 12 quarters ahead, estimated on quarterly bank-level data for the sample of 10 countries included in the stress testing exercises, along with the corresponding 95-percent confidence bands. Standard errors are clustered by time and country. Variables are scaled so that the estimated coefficient represents the impact of a 1-percentage-point reduction in a banks' Tier-1 capital ratio. A 1-percentage-point lower Tier-1 capital ratio is associated with 1.5 percentage points lower real lending after 10–12 quarters. The effect is statistically significant from five quarters onward and grows over time. Our estimates suggest a strong correlation between bank capital and bank lending.[24] Since capital structure and lending decisions may be taken simultaneously (Karmakar and Mok 2015), the effect should not be interpreted as causal. Nonetheless, our results show that declines in bank capital, on average, correlate with declines in bank lending, highlighting that decreases in bank capital in a banking sector stress scenario could have broader economic impacts.

5.2. Impact on Output

If bank capital declines and lending subsequently contracts, this could lead to broader macroeconomic consequences as the credit contraction may lead to lower output growth (see Kiyotaki and Moore 1997; Brunnermeier and Sannikov 2014; Amiti and Weinstein 2018). Using the micro estimates from section 5.1 to calibrate the size of credit shocks in a banking sector stress scenario, we now estimate a small-scale macroeconometric model to analyze the link between credit fluctuations and economic growth.

[24] Several robustness exercises (available upon request) confirm that this relationship holds qualitatively and quantitatively to the inclusion of country-time fixed effects rather than country-level macro controls, to the use of real asset growth rather than real lending growth, and to the inclusion of banks' leverage ratio (Equity/Assets) instead of Tier-1 capital ratios.

The model consists of two blocks: one equation for credit fluctuations and one that governs output:

$$c_t = \rho_1 c_{t-1} + \rho_2 y_{t-1} + \epsilon_t^c \quad (5)$$

$$y_t = \alpha_1 y_{t-1} + \alpha_2 \epsilon_t^c + \epsilon_t^y \quad (6)$$

where c_t is the real credit gap in quarter t, y_t is the output gap. ϵ_t^c and ϵ_t^y are stationary first-order autocorrelated shocks.[25] We estimate the model using quarterly data from 2000 Q1 to 2023 Q1 for the sample of 10 countries that are part of the banking sector stress test. Details on model estimation are discussed in Annex 4.

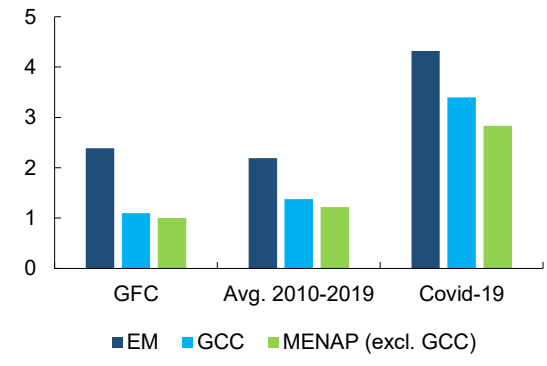
Output would contract by 0.7 percent in MENA and 0.4 percent in the GCC if the combined banking sector stress scenario from the previous section was to materialize (Figure 12, panel 2). Across countries, potential output losses in MENA (excluding the GCC) and Pakistan range from 0.2 to 1.2 percent. In the GCC, output could contract by between 0.05 and 1.2 percent. Hence, banking sector stress in the MENA region could negatively weigh on economic growth. This result on the relationship between bank capital and growth in MENA complements the findings of Aziz (2020), who shows that bank profitability is positively related to economic growth in Arab countries. Our estimates likely underestimate the actual output losses since several general equilibrium channels are not directly modeled. Banking sector stress that requires bank recapitalization would also have a fiscal impact on the respective government, and banking sector stress could lead to fire sale externalities (Caballero and Simsek, 2013; Kara and Ozsoy 2020) that trigger an adverse feedback loop.

6. Macroprudential Frameworks in MENA

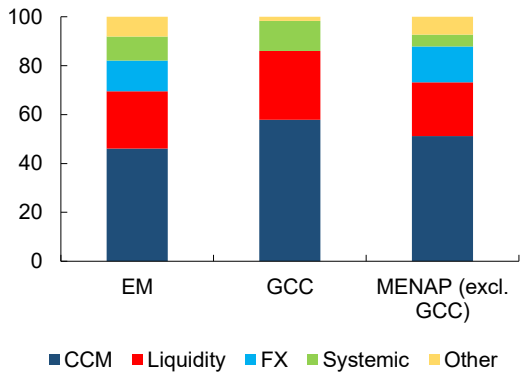
To build ex-ante resilience against macroprudential risks and the potential macrofinancial amplification of those, macroprudential policy tools have been ramped up since the financial crisis (Alam and others 2019). In this section, we use the IMF Integrated Macroprudential Policy Database to analyze the state of macroprudential policy in the MENA region. Figure 13 provides an overview of the average number of macroprudential actions in the GCC and MENA (excluding GCC) over time, as well as the distribution of macroprudential actions across different policy areas (credit and capital-related measures, liquidity, FX, systemic risks, and others).

Figure 13. Macroprudential Frameworks

1. Average Number of Macroprudential Actions per Country per Year (Number)



2. Distribution of Macroprudential Actions (2017-2021, Share of total measures used)



Sources: IMF Integrated Macroprudential Policy Database and IMF staff calculations.

Note: CCA = Caucasus and Central Asia; CCM = Credit and Capital Related Measures; EM = All emerging markets per WEO definition, excluding MENAP and CCA; GCC = Gulf Cooperation Council; GFC = Global Financial Crisis and MENAP = Middle East, North Africa, Afghanistan, and Pakistan.

[25] ϵ_t^y captures all demand shocks uncorrelated with domestic credit shocks, for example, real interest rates and exchange rates, commodity prices, and global demand shocks.

Overall, the use of macroprudential policies in the MENAP region has been slow and subdued compared to other emerging markets (Figure 13, panel 1). Credit and capital-related tools dominate in the GCC and MENAP (Figure 13, panel 2) followed by liquidity-based tools. Almost all countries in the region have some broad-based macroprudential tools regarding capital buffers in place, such as the countercyclical capital buffer (CCyB). However, many countries have never activated the CCyB. Furthermore, while most countries have implemented borrower-based tools for the household sector, such as a cap on debt-service-to-income ratios, tools to guard against pockets of vulnerability and elevated credit risk in the nonfinancial corporate sector have generally been less utilized. In addition, some countries in the GCC have not employed measures to reduce banks' foreign currency liquidity risks, and some MENA countries have taken fewer actions to reduce risks from systemically important domestic financial institutions. Such differences may reflect the nature of the risks faced by banks and the level of financial development in each sub-region but could also leave key gaps in addressing potential vulnerabilities.[26] At the same time, countries that more frequently use macroprudential tools, other things being equal, tend to experience stronger and less volatile GDP growth, though the effects are influenced by each economy's openness and financial development (Boar and others 2017).

7. Conclusion

This paper conducts the first corporate sector and banking sector stress tests for the MENA region using granular firm-level and bank-level data and common shock scenarios across ten countries. Our stress testing exercises rely on publicly available data, are easy to update, customize, and replicate, and can be extended to other countries in the region or beyond.

While corporate sectors in the MENA region have remained resilient—and the share of zombie firms declined during COVID-19 amid public policy support—higher-for-longer interest rates pose sizable risks to the corporate sectors in the region. In our stress scenario, corporate sector return on assets declines from 5 percent to 3 percent. Lower profitability and higher rates put downward pressure on interest coverage ratios, which decline from a current median of 3.5 to 1.5. As a result, the share of zombie-held debt could increase from 12 to 30 percent of total corporate sector debt.

This corporate sector stress could spill into the banking sector. In the banking sector stress test, we simulate the joint impact of credit stress—using the corporate sector stress test results—and liquidity shocks amid higher interest rates. Overall, MENA banking sectors appear resilient in our banking sector stress test even under a joint liquidity and credit stress scenario amid higher-for-longer interest rates. Vulnerabilities are more pronounced in non-GCC countries where losses are higher and hence bank capital would decline more in a stress scenario. In the cross-section of banks, those banks with weak fundamentals (for example, low profitability, low holdings of liquid assets, high leverage) and state-owned banks are more vulnerable to banking sector stress. While banking sectors appear resilient and recapitalization needs would be modest, bank capital would decline by 2.3 percentage points in the GCC and by 4 percentage points in non-GCC MENA countries. Declining bank capital may adversely affect lending and growth if banks rebuild their capital buffers by shrinking their balance sheets.

[26] For example, see the IMF's Financial Development Index Database for metrics on financial institutions and markets in the region compared to other parts of the world.

Our results suggest that policymakers in the region should be attentive to financial stability risks for corporates and banks in a higher-for-longer interest rate environment. Some specific tools may be considered. First, our analysis shows that the use of broad-based macroprudential tools, such as the countercyclical capital buffer, remains subdued in MENA as compared to other emerging markets. Second, the bank-sovereign nexus remains a substantial vulnerability in some countries. In those countries where banking systems face elevated interest rate risk, preserving bank capital would preserve loss absorption capacity. Conducting bank stress tests with a specific focus on the sovereign-bank nexus would further help regulators to understand the nature and severity of these risks while, over the medium term, developing alternative funding sources for domestic sovereign bonds can contribute towards reducing the nexus by diversifying the investor base.

Finally, if borrower defaults rise, domestic banks may face incentives to delay the recognition of loan losses by evergreening credit to firms at advantageous rates. This can lead to long-lasting buildups of NPLs, which constrain bank lending, and the resulting emergence of zombie firms could weigh on aggregate productivity growth (Caballero and others 2008). Therefore, resolution regimes should facilitate a swift resolution of NPLs to prevent banks from building up impaired legacy assets on their balance sheets.

Annex I. Corporate Stress Tests

This annex provides details on how firm profitability (proxied by EBIT) is calibrated in the two years of the stress test (2023-2024). For each firm, we randomly draw a return from a sector-specific distribution $N(\mu, \sigma)$. The mean (μ) and standard deviation (σ) were calibrated to the first and second year during and after the Global Financial Crisis (GFC). As robustness, the first and second years of the 2015 oil price shock are considered as well. Standard deviations were capped at 50 percent.

Annex Table 1. Calibration of Firm Profitability Shocks

(percent)

	GFC Shock				2015 Oil Shock			
	2023		2024		2023		2024	
	μ	σ	μ	σ	μ	σ	μ	σ
Capital goods	-7.6	17.1	5.9	50	-1.1	50	6.6	50
Energy	-15.7	36.4	-12.2	50	-16.4	50	-12.0	28.5
Food & beverages	5.9	39.1	-1.4	50	-4.0	50	-13.9	50
ITC	-10.2	21.7	-3.3	50	-6.6	45	-3.6	50
Materials	-12.7	50.0	-6.9	50	1.0	50	-7.6	50
Pharma	-4.8	36.8	12.6	50	11.0	50	6.7	50
Real estate	-25.8	50	2.0	50	-5.8	50	-11.7	50
Retail	-7.8	50	21.4	50	-11.6	50	-2.8	50
Services	-3.3	50	2.8	50	-11.2	50	-18.4	50
Transportation	-25.6	50	-16.3	50	-0.9	50	10.5	50
Utilities	1.0	50	12.0	50	-6.6	8	-2.3	50
Total	-9.6	42.3	2.6	50	-4.5	48.2	-5.7	49.2

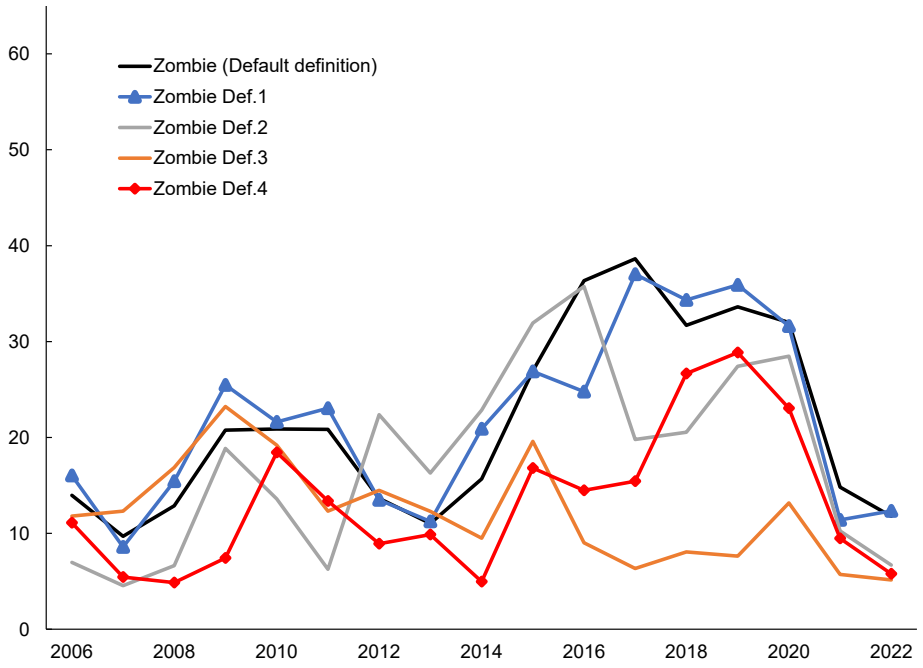
Additionally, we provide a few robustness checks to the zombie definition used in this paper (Annex Figure 1.1). Our default definition was originally applied by Acharya et al. (2019) to euro area countries over 2009-15—later used in Acharya et al. (2022) for US firms. This definition considers zombies as firms with low interest coverage ratio (ICR) over a period of two years and an implicit interest rate lower than highly rated peers, i.e., at least AA-rated. The low ICR threshold (2.5) is calibrated based on the firm distribution. In our sample, the median ICR over the 2018-2022 period (last 5 years) was 2.7, very close to this threshold. Thus, we employ the same level to define zombie firms. As alternatives, we use three additional definitions. First, we relax the persistency in the ICR ratio and define firms as zombies if the ICR is lower than 2.5 in the current year, while they pay a "subsidized" interest. Second, we relax the "subsidized" interest assumption, which has recently received some criticism, and rely on the definition proposed by Albuquerque and Iyer (2023) and Minoiu et al. (2022). The second definition refers to three conditions to be simultaneously met: i) negative real revenue growth; ii) an ICR below a threshold; and iii) a leverage ratio above the median firm in the same industry. To keep it consistent with our sample and previous definition, we maintain the same threshold for ICR, namely 2.5. Third, we employ the definition suggested by Havemeister and Horn (2023), combining three conditions: i) negative return on assets; ii) debt service capacity below a certain threshold; and iii) negative net investments. Due to lack of data in our sample, we only focus on the first two conditions. The fourth alternative definition is similar to the default one, but the condition on subsidized lending is now protracted (for two consecutive years).

The results from these alternative zombie measures lead to consistently similar shares of corporate debt (as percent of total), except for the third definition which has a subdued hump during and after the oil price shock.

Annex Figure 1.1. Robustness Check: Zombie Definition

Corporate Debt Held by Zombie Firms

(Percent of total debt)



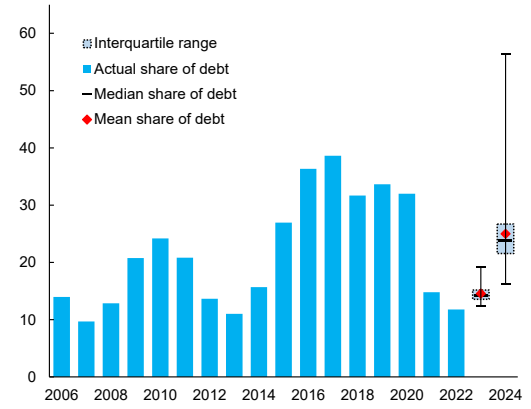
Sources: S&P Capital IQ; and IMF staff calculations.

Note: The default definition follows closely Acharya and others (2022). Definition 1 is similar to the default, but only in the current year (no persistency). Definition 2 follows closely Albuquerque and Iyer (2023), while definition 3 is based on Havemeister and Horn (2023). Definition 4 is similar to the default, but with protracted subsidized lending (full persistency).

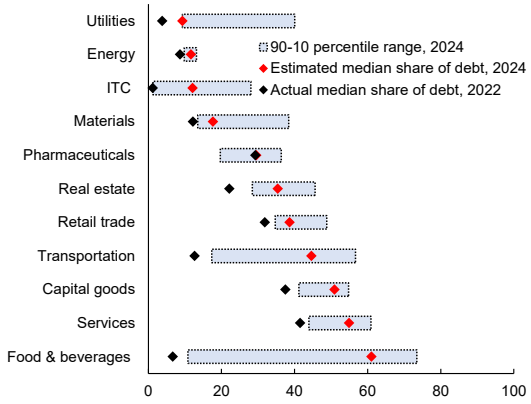
As robustness check, a downside scenario with a more persistent profitability shock is employed, mimicking the sectoral firm performance after the 2015-16 oil price downturn. This oil price shock is particularly relevant to the MENA region, given the high sensitivity of the outsized energy sector. The results presented in Annex Figure 1.2, show that the share of zombie-held debt could increase to 25 percent of total debt by 2024, with a relatively larger interquartile range (18-58). The higher variance is explained by the larger firms sensitive to low oil prices, which could potentially lead to outsized losses if this risk materializes.

Annex Figure 1.2. Robustness Check: Corporate Debt at Risk (Oil Shock Scenario)

1. Corporate Debt Held by Zombie Firms
(Percent of total debt; simulation results for 2023–24)



2. Share of Debt Held at Zombie Firms by Sector
(Percent of total debt; simulation results for 2024)



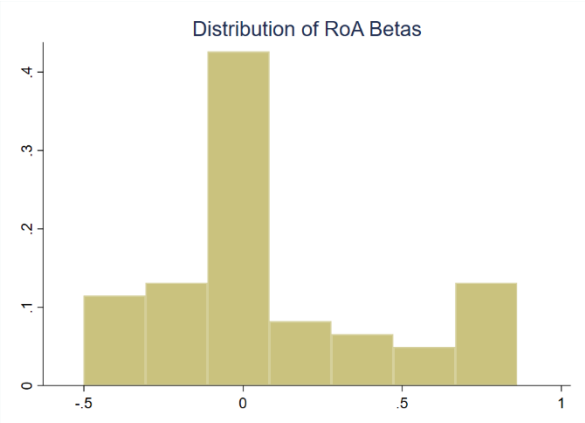
Sources: S&P Capital IQ; and IMF staff calculations.

Note: ICR = Interest Coverage Ratio; EBIT = Earnings before interest and taxes; Country coverage: AZE, BHR, EGY, JOR, KAZ, KGZ, KWT, LBN, MAR, OMN, PAK, QAT, SAU, SDN, TUN, and UAE.

Annex II. Estimation of RoA Betas

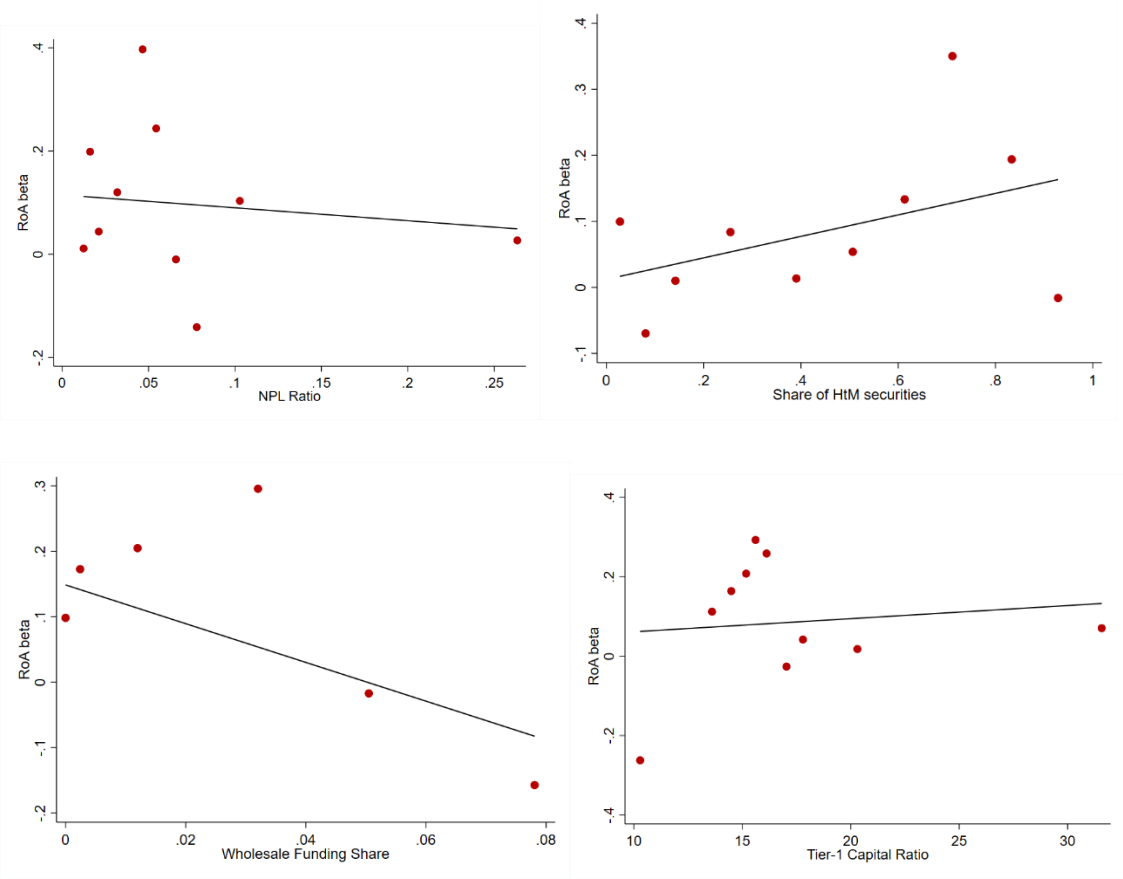
Annex Figure 2.1 shows the distribution of estimated RoA betas for a sample of banks including Bahrain, Egypt, Kuwait, Jordan, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, and the United Arab Emirates. While the bulk of estimated betas are close to zero, there is sizable variation. Notice that not all banks benefit from increasing interest rates as 1/3 of banks have negative RoA betas.

Annex Figure 2.1. Distribution of RoA Betas



To better understand which bank-level characteristics drive the distribution of estimated betas, we compute the the correlation of RoA betas with several bank-level characteristics—NPL ratio, the share of held-to-maturity securities, the share of wholesale funding, and Tier-1 capital ratios. Annex Figure 2.2 shows binned scatter plots of RoA betas against several bank-level characteristics. Since bank-level characteristics are not constant over time, we use the within-bank median of each characteristic for the plot.

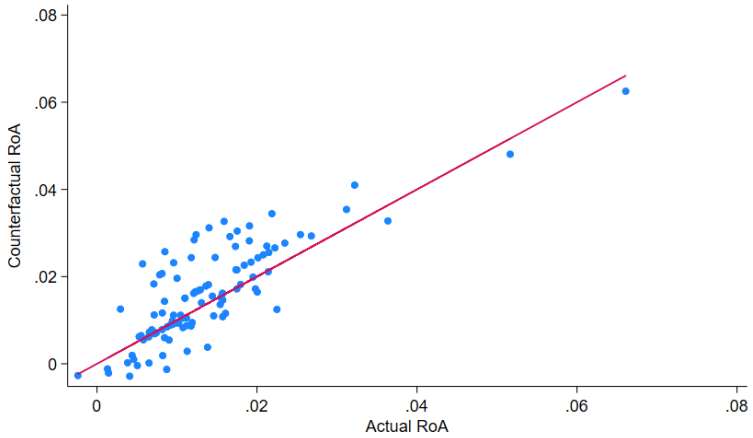
Annex Figure 2.2. Bank Characteristics and RoA Betas



Banks with lower NPL ratios, a higher share of held-to-maturity securities which are not marked-to-market, a lower share of wholesale funding, or higher Tier-1 capital ratios have higher RoA betas. Hence, the estimated RoA betas align intuitively with several bank-level characteristics that theoretically would determine the sensitivity of bank profitability to interest rates.

Finally, we show that accounting for changes in banks' net income is critical for the stress test. The next figure shows a scatter plot of actual profitability (measured as RoA) versus the counterfactual RoA after allowing for interest changes from higher for longer interest rates.

Annex Figure 2.3. Actual RoA and Estimated RoA



Clearly, most of the banks (about two-thirds) benefit from higher rates as evidence by their counterfactual profitability exceeding their actual profitability. Visually, the majority of the blue dots lies above the 45-degree line. Nonetheless, several banks (about one-third) lie on or below the 45-degree line, suggesting that they are not estimated to benefit from higher rates. Moreover, those banks below the 45-degree line tend to have lower ex-ante profitability. Hence, the banks that stand to be negatively impact by higher interest rates tend to be ex-ante more vulnerable. This highlights the importance of taking into account the endogenous change in net income to higher interest rates. In the stress testing exercises, net income is the first buffer that banks have to absorb losses. For example, when provisioning needs rise because of corporate sector stress, more profitable banks can more easily absorb the increased provisioning needs.

Annex III. Details of Bank Stress Test

Liquidity Stress Test

The liquidity stress testing exercise simulates how banks in MENA would fare in case of a sudden withdrawal of deposits amid a higher-for-longer interest rate environment. The methodology is built on the recent paper by Jiang and others (2023) and work by Copestake, Kirti, and Liu (2023). When faced with deposit withdrawals, banks would first exhaust their cash buffers, without any impact on the securities portfolio. If deposit withdrawals exceed existing cash buffers, banks would have to sell parts of their securities portfolio. Government securities, which are likely to be the most liquid ones in MENA countries, would likely be the first assets to be sold before any other securities or, if outflows can still not be covered, loans would be sold at last. Using valuation assumptions based on the increase in interest rates and the changes in sovereign spreads observed since early 2022, this liquidity component of our stress test provides insights into the size of potential capital losses that may materialize for banks in MENA if there are sudden funding withdrawals.

The liquidity stress-test methodology[27] involves three steps. First, we mark banks' sovereign bond holdings and other securities holdings to market. Second, we use scenarios as discussed in the main text to calibrate the size of deposit withdrawals, which in turn determine the size of asset sales required, at current market values, to meet these withdrawals. Third, we scale the resulting realized losses by regulatory capital if they exceed ex-ante net income.

[27] Methodology developed by Copestake et al. (2023) and adopted with changes to MENA countries. The following exposition partly draws on their work.

Market values: On the asset side, we distinguish between sovereign bonds and other securities. We start with the reported book value of the sovereign bond portfolio. Without reliable pricing data on local currency government bonds for many of the countries in our sample,[28] we use the change of the US yield curve since January 2022 at the duration of the portfolio of local currency sovereign bonds outstanding in each country, plus an additional country-specific spread, as a proxy. This gives:

$$Discount_c = \left[\Delta_{Today-1/1/22} r_{UST}(\overline{Duration}_c) + \Delta_{Today-1/1/22} Spread_c\right] \times \overline{Duration}_c$$

where $\overline{Duration}_c = \sum_j (w_{j,c} \times Duration_{j,c})$ where $w_{j,c}$ is the share of bond j in all outstanding bonds of country c. $Spread_c$ is the par-value weighted spread across the country's sovereign bonds with more than one-year remaining maturity, calculated from the IMF Sovereign Debt Monitor.

Given the illiquidity of many sovereign bond and corporate bond markets in the region, we impose a fire sale discount on the sale of fixed income securities throughout. The discount is simulated based on the increase in sovereign spreads between February 2020 and the average from July-September 2020 during the COVID-19 pandemic. We draw 1,000 times for each bank and country and report the median result throughout.

Bank data are from Fitch Connect, bond data are from Bloomberg Finance L.P., and yield curve changes from the Federal Reserve.

Withdrawal scenarios: Turning to liabilities, we distinguish between three types of funding: resident deposits, non-resident deposits, and other short-term funding (for example, wholesale funding). Throughout, we assume a 20 percent withdrawal of resident deposits. For nonresident deposits, we assume a stronger 30 percent withdrawal, with nonresident deposits inferred using the country-level share of nonresident deposits. We also assume 30 percent withdrawal of wholesale funding and other short-term funding. We assume that banks initially meet withdrawals using their available cash and equivalent liquid assets and face no market value losses in doing so.

$$EWithdrawals_b^S = .2\ Domestic\ Deposits_b + .3\ (Wholesale_b + Foreign\ Deposits) - Cash_b$$

where we constrain that $EWithdrawals_b^S \geq 0$.

Using these scenarios, we back out the book value of securities that must be sold—at current market prices—to raise sufficient funds to meet withdrawals.[29] The larger the MTM discounts, the more book-value securities must be sold. We assume for simplicity that banks first sell off sovereign bonds, and only sell other securities if sovereign bond sales are insufficient. Throughout, banks first sell mark-to-market assets and only then securities with unrealized capital losses.[30] If all securities are sold, other remaining assets are sold at a further discount. This pins down sales of each type of asset in each withdrawal scenario:

[28] In many MENA countries, liquidity in local currency bond markets is low amidst limited secondary market trading, implying that yield curves are not well-established.

[29] We assume the sales occur at the current market prices minus a fire sale discount as described above.

[30] Based on available information, we assume that banks first liquidate available-for-sale (AFS) securities and only then held-to-maturity securities. This avoids over-estimating losses since AFS securities are already mark-to-market. Nonetheless, banks realize additional losses on their AFS securities when selling those because of to the fire sale discount that is simulated. This accounts for the illiquidity of many secondary bond markets in the region where selling larger amounts of government bonds is likely to induce a negative price impact.

$$SovBondSales_b^S = \begin{cases} \dfrac{EWithdrawals_b^S}{[1-Discount_c]} \text{ if } \dfrac{EWithdrawals_b^S}{1-Discount_c} < SovBonds_b^{2022} \\ SovBonds_b^{2021} \text{ if } \dfrac{EWithdrawals_b^S}{1-Discount_c} \geq SovBonds_b^{2022} \end{cases}$$

$$OtherSecSales_b^S = \begin{cases} 0 & \text{if } \dfrac{EWithdrawals_b^S}{1-Discount_c} < SovBonds_b^{2022} \\ \dfrac{EWithdr.s_b^S - SovBonds_b^{2021} \times [1-Disc.t_c]}{\left[1-\widehat{Discount_c}\right]} & \text{if } \dfrac{EWithdrawals_b^S}{1-Discount_c} \geq SovBonds_b^{2022} \end{cases}$$

$$OtherAssetSales_b^S = \begin{cases} 0 & \text{if } EWithdrawals_b^S < T \\ \dfrac{EWithdrawals_b^S - T}{\left[1-1.3\times\widehat{Discount_c}\right]} & \text{if } EWithdrawals_b^S \geq T \end{cases}$$

where $T = SovBonds_b^{2022} \times [1-Disc.t_c] + OtherSecurities_b^{2022} \times \left[1-\widehat{Discount_c}\right]$. The resulting value of assets is then (in the case that $EWithdrawal_b^S > 0$):

$$Assets_b^S = SovBonds_b^{2022} - SovBondSales_b^S + OtherSecurities_b^{2022} - OtherSecSales_b^S + OtherAssets_b^{2022} - Cash_b - OtherAssetSales_b^S$$

Assessing losses: To assess banks at risk, we compare losses to regulatory capital, after taking into account net income buffers. Specifically, we focus on those losses that exceed net income and can thus not be absorbed by banks' ex-ante profitability.

$$Excess\ Losses_b^S = SovBondSales_b^S \times Discount_c + OtherSecSales_b^S \times \widehat{Discount_c} + OtherAssetSales_b^S \times 1.3 \times Discount_c \widehat{-Net\ Income_b}$$

For the corporate scenario, we first compute the counterfactual net income that would arise if banks provision 100 percent against the projected increase in NPLs under the corporate stress scenario. And then compute the excess losses relative to that benchmark.

Annex IV. Model of Macrofinancial Linkages

Model

We use a two-equation macro model that links credit and business cycle fluctuations.

The first block of the model assumes that credit fluctuations are largely related to the business cycle. In other words, a strong (weak) economy leads to strong (weak) credit:

$$c_t = \rho_1 c_{t-1} + \rho_2 y_{t-1} + \epsilon_t^c$$

where c_t is the real credit gap, y_t is the real output gap, and ϵ_t^c is a stationary autocorrelated shock to real credit ($\epsilon_t^c = \phi\epsilon_{t-1}^c + \varepsilon_t^c$). Thus, banks are assumed to set their desired level of credit based on past levels of economic activity. Because banks cannot immediately adjust credit levels[31] (for example, due to an inability to recall credit that has already been extended), it is also assumed that credit levels are slow to adjust to output fluctuations, reflected in the term $\rho_1 c_{t-1}$.

The second block of the model links credit fluctuations to economic growth. It is assumed that shocks to credit that are unrelated to past levels of output and inertia reflect changes in the lending practices of banks that can directly affect output. In this simple model, the output gap is assumed to be related to its own lag and "autonomous" credit shocks:

$$y_t = \alpha_1 y_{t-1} + \alpha_2 \epsilon_t^c + \epsilon_t^y$$

where ϵ_t^y is a stationary autocorrelated demand shock ($\epsilon_t^y = \tau\epsilon_{t-1}^y + \varepsilon_t^y$) that is assumed to capture all demand shocks uncorrelated with domestic credit shocks including real interest and exchange rates, commodity prices, and global demand shocks.

All shocks (denoted ε_t^x for variable x_t) are assumed to be independently and identically distributed white noise processes. The output and credit gaps are expressed as percentage point deviations from long-run trends:

$y_t = Y_t - \bar{Y}_t$, and $c_t = C_t - \bar{C}_t$
where Y_t and C_t are (log) levels of real GDP and real credit, respectively, and $\bar{Y}_t$ and $\bar{C}_t$ are their associated long-run trends. Finally, the long-term trends are assumed to follow I(2) processes**:**

$\Delta\bar{Y}_t = \Delta\bar{Y}_{t-1} + \varepsilon_t^{\bar{Y}}$, and $\Delta\bar{C}_t = \Delta\bar{C}_{t-1} + \varepsilon_t^{\bar{C}}$**,**

Data and Estimation

The parameters and trends in the model described above are estimated country by country using quarterly data from Haver Analytics ranging from 2001Q4 to 2023Q1 using the Kalman filter and Bayesian methods (estimation details are available on request). The observable variables used for each country are real GDP and real credit, where real credit is defined to be banking sector claims on the non-financial private sector and nominal credit is deflated with the CPI. The long-term trends in the model are calibrated using the HP filter with the standard smoothing parameter for quarterly data (1600).

[31] For example, in Khwaja and Mian (2008), Pakistani banks take about one quarter before the impact of a bank liquidity shock is passed on into bank lending.

Estimated Output Responses Following Past Credit Downturns

The main text reports results from two exercises. First, using historical data on credit downturns ($\hat{\epsilon}_t^c < 0$), we plot the distribution of output losses defined as the two-year average output loss following historic credit downturns. This exercise, labeled “historical credit downturns” in Figure 11, panel 2, provides a historic benchmark on the severity of credit downturns in the region. Second, we map the declines in bank capital under the stress test scenario into a decline in credit using the estimates from equation (4). Then, using the estimated macro-econometric model, we compute the implied country-by-country output losses. This yields the “stress scenario” results in Figure 11, panel 2.

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