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Central Bank Digital Currencies in the Middle East and Central Asia

Prepared by Serpil Bouza (lead), Bashar Hlayhel, Thomas Kroen, Marcello Miccoli, Borislava Mircheva (lead), Greta Polo, Sahra Sakha, and Yang Yang

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Acronyms and Abbreviations

AML	anti–money laundering
CBDC	central bank digital currency
CBJ	Central Bank of Jordan
CBL	Central Bank of Libya
CCA	Caucasus and Central Asia
CIC	cash in circulation
CFT	combating the financing of terrorism
DLT	distributed ledger technology
DT	digital tenge
FCS	fragile and conflict-affected state
GCC	Gulf Cooperation Council
LIC	low-income country
ME&CA	Middle East and Central Asia
MENA	Middle East and North Africa
MENAP	Middle East, North Africa, Afghanistan, and Pakistan
NBK	National Bank of Kazakhstan
PSP	payment service provider
RoA	return on assets
RTGS	real-time gross settlement

Executive Summary

In a rapidly digitalizing world, central banks are increasingly examining the role of central bank digital currencies (CBDCs). CBDCs offer central banks a promising avenue by providing a digital alternative to cash, but their implementation raises several policy and operational issues that require careful consideration.

A survey of IMF country teams shows that 19 central banks in the Middle East and Central Asia (ME&CA) are exploring issuing a CBDC, and 7 have already benefited from IMF capacity development on this topic. The survey finds that ME&CA countries are mainly focused on how CBDCs can enhance financial inclusion and payment system efficiency. Specifically, in Middle East and North Africa oil exporters and the Gulf Cooperation Council countries, where financial markets are relatively more developed, the priority is making both domestic and cross-border payments more efficient, while for Middle East and North Africa oil importers, the Caucasus and Central Asia, and low-income countries, it is expanding financial inclusion.

This paper frames key questions ME&CA policymakers should ask when considering the adoption of CBDCs: What objectives do policymakers aim to achieve with a CBDC? Which inefficiencies in payment systems can CBDCs address? What are the implications of CBDC issuance for financial stability, monetary policy pass-through, and central bank operational risk? How can CBDC design help achieve policy objectives and mitigate these risks? This paper provides preliminary answers to these questions for ME&CA economies. However, since there are no clear economic prerequisites for CBDC issuance, more detailed analysis is needed for country-specific considerations that fully account for respective economic and financial conditions. Hence, the paper does not seek to recommend whether countries should issue a CBDC.

The paper provides the following novel findings specific to ME&CA countries:

- *CBDCs could promote financial inclusion if they address the inherent inefficiencies of the payment system*. In the ME&CA region, access to bank accounts is low, segments of the population are underserved by existing digital means of payment, and reliance on cash is high, including for sending and receiving remittances, particularly in low-income Middle East and North Africa countries. CBDCs, if offered at a lower cost than existing alternatives, could spur competition in the payment market and help increase access to bank accounts, improve financial inclusion, and update legacy technology platforms. However, without remedying some inherent barriers to increased uptake of digital accounts and payment systems (for example, low digital and financial literacy, distrust in financial institutions, and low wealth), CBDC uptake may be limited and provide only marginal benefits.

- *CBDCs may help improve the efficiency of cross-border payment services*. If designed to address frictions from a lack of payment system interoperability, complex processing of compliance checks, long transaction chains, and weak competition, the cost of cross-border transactions could decrease significantly. Some ME&CA countries are already launching new cross-border technology platforms to address these issues and promote digital currency payments between countries.

- *CBDCs could have financial stability implications, especially for banks relying heavily on deposits*. CBDCs may compete with bank deposits, a primary funding source for ME&CA banks, reducing bank profitability and lending volumes. However, banking systems in the region generally have adequate capital, profitability, and liquidity buffers, which could mitigate potential adverse impacts from CBDC competition. Applying a small structural model to three ME&CA economies representative of the broad country groupings in this region, we find that CBDCs could reduce the share of cash, especially in cash-reliant ME&CA economies (for example, in the Caucasus and Central Asia and the Middle East, North Africa, Afghanistan, and Pakistan). In addition, there would be a limited impact on deposits and profitability for

commercial banks, partly due to the relatively higher concentration of ME&CA banking systems. Still, it is important to monitor the entire distribution of banks. While there are no clear prerequisites to adopting CBDCs, a healthy banking system, a sound legal basis, and strong supervisory and regulatory capacity are paramount to tackling any possible adverse implications.

- *CBDCs could potentially impact monetary policy pass-through*. CBDCs could strengthen monetary policy pass-through into deposit rates by increasing competition and reducing the banking system's market power. CBDCs could also strengthen the bank lending channel of monetary policy. However, the impact, which would be country-specific, is difficult to estimate due to limited CBDC uptake.

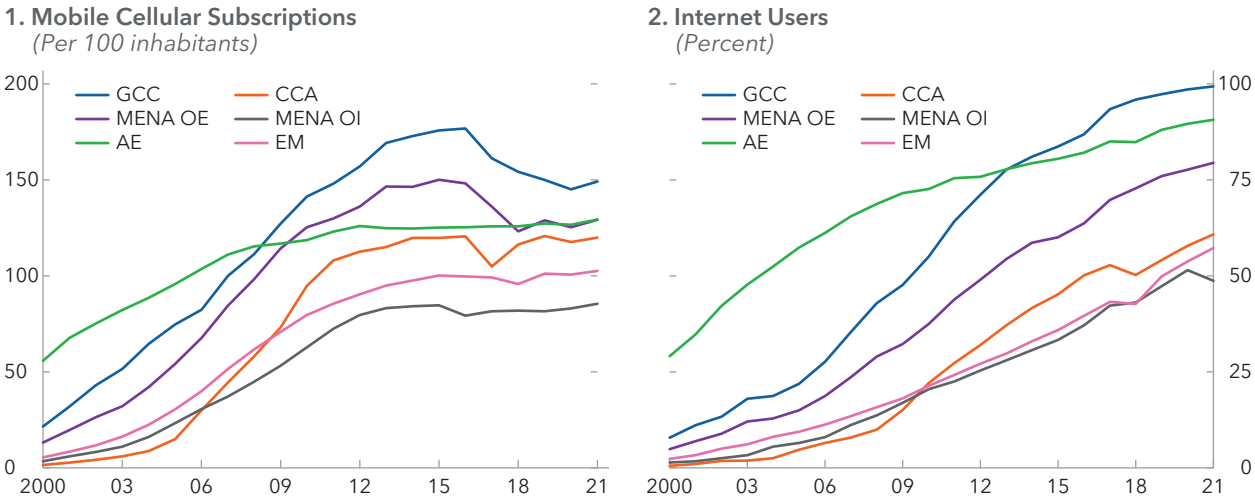
The selection of appropriate design features is a common challenge to CBDC implementation in ME&CA countries. Careful CBDC design can help policymakers achieve policy objectives, address inefficiencies in the payment system, and mitigate potential negative implications. Policymakers should consider design features meticulously to ensure that policy objectives can be met, CBDC implementation aligns with the "do no harm" principle to monetary and financial stability, and CBDCs are a safe and trusted means of payment. For instance, designing CBDCs to work "offline" could be fundamental to achieving financial inclusion in areas with low data connectivity, such as in low-income countries and fragile and conflict-affected ME&CA economies. Similarly, the availability of CBDCs for cross-border transfers could reduce costs and increase speed for remittances.

CBDC issuance and adoption is a long journey that ME&CA policymakers should approach with care. Policymakers need to analyze comprehensively whether a CBDC serves their country's objectives and whether the expected benefits outweigh the potential costs, risks for the financial system, and operational risks for the central bank. Policymakers need to be mindful that the debate on the implications of CBDCs for the financial system, monetary policy, and the economy overall is still ongoing and requires further research. Finally, there may be alternative solutions to achieving intended policy goals, such as adopting or improving other digital payment systems. Therefore, policymakers should clearly define and communicate what they aim to accomplish with CBDC issuance. Through capacity development and surveillance, the IMF stands ready to support and guide policymakers in evaluating the need to issue a CBDC and establishing strong policies and regulatory frameworks to minimize possible adverse implications to monetary and financial stability.

1. Introduction

The world is moving rapidly toward a digital future, raising questions and challenges for central banks. Digital technologies have advanced faster than any innovation in human history (Figures 1 and 2), and the COVID-19 pandemic accelerated this pace (Abidi, El-Herradi, and Sakha 2023). To keep up with this trend and harness its significant economic benefits, governments are adopting digitalization strategies to transform public services and increase their efficiency.[1] With payments becoming increasingly digitalized, one question is whether a structural shift from a reliance on cash to digital currencies could materialize. Many central banks are reflecting on how to achieve their policy objectives in this changing landscape. One option to preserve the key role of central bank-issued money in a digital world is to adopt a central bank digital currency (CBDC). A CBDC is a digital liability of the central bank used as a means of payment by the population (retail) or financial institutions (wholesale).

Figure 1. Digital Ecosystems in ME&CA



Sources: International Telecommunication Union; and IMF staff calculations.
Note: AE = advanced economy; CCA = Caucasus and Central Asia; EM = emerging market; GCC = Gulf Cooperation Council; ME&CA = Middle East and Central Asia; MENA = Middle East and North Africa; OE = oil exporter; OI = oil importer.

As of October 2023, 130 countries, representing 98 percent of global GDP, were exploring the potential use of a CBDC (Kosse and Mattei 2022).[2,3] A survey of IMF country teams representing 31 Middle East and Central Asia (ME&CA) economies[4] finds that 19 countries are considering or exploring a CBDC. This is consistent with information from country authorities' public statements (Figure 3). Most ME&CA countries interested

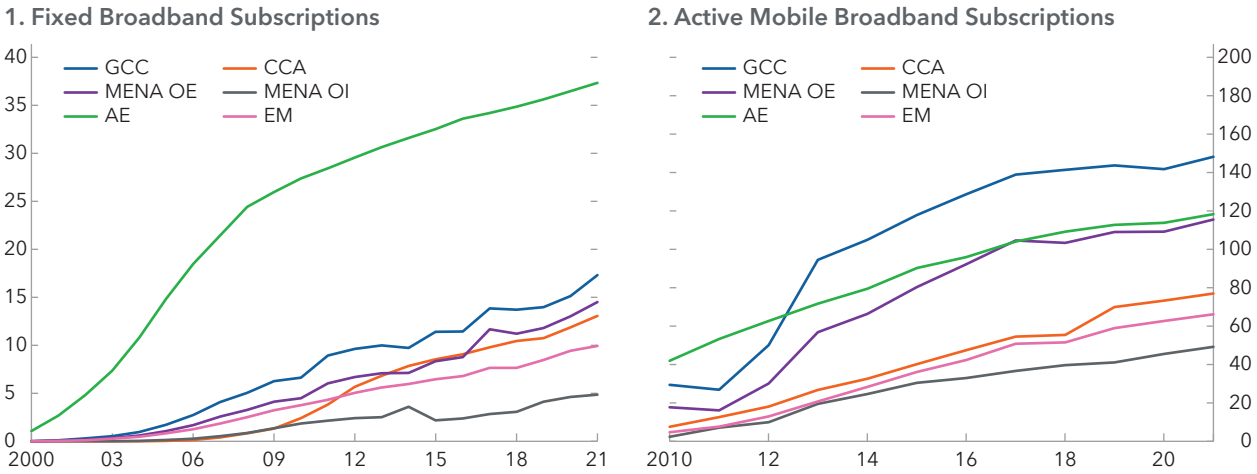
[1] Saudi Arabia established a Digital Government Authority in March 2021. During the same year, the United Arab Emirates re-established the Telecommunications Regulatory Authority as the Telecommunications and Digital Government Regulatory Authority, which recently published its Digital Transformation Enablers Report, highlighting the government's key achievements.

[2] See also https://www.atlanticcouncil.org/cbdctracker/.

[3] A total of 11 countries have fully launched a CBDC: Anguilla, The Bahamas, the Eastern Caribbean Central Bank (comprising seven Caribbean countries), Jamaica, and Nigeria. Of the countries that have already formally introduced a CBDC, all have been in the form of a retail CBDC. A few other central banks are in the pilot stage for a CBDC. For example, China's pilot CBDC is currently reaching 260 million people and encompasses both wholesale and retail capabilities. However, many countries remain in the preliminary research stages, and over 50 percent of these have begun their proof of concept. As of December 2022, all Group of Seven economies had moved into the development stage of a CBDC. For example, the New York Federal Reserve's wholesale CBDC, Project Cedar, recently shifted from research to development (Lipsky and Kumar 2022). More than 20 countries are expected to have taken significant strides toward piloting a CBDC in 2023.

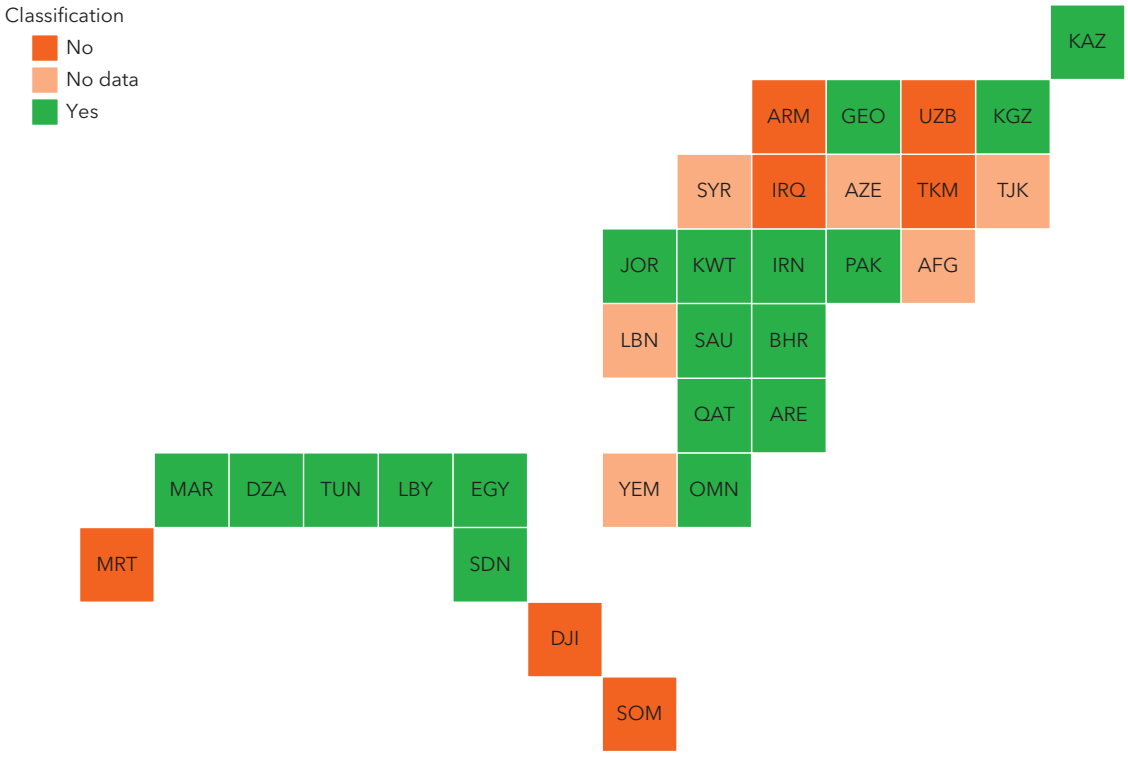
[4] This survey of IMF country teams is based on IMF economists' knowledge of country authorities' plans regarding CBDCs. See details in Annex 1.

Figure 2. Broadband Ecosystem in ME&CA
(Per 100 inhabitants)



Sources: International Telecommunication Union; and IMF staff calculations.
Note: "Fixed broadband subscriptions" refers to fixed subscriptions to high-speed access to the public internet (a TCP/IP connection) at downstream speeds equal to or greater than 256 kbits per second. "Active mobile broadband subscriptions" refers to the sum of active handset-based and computer-based (USB/dongles) mobile broadband subscriptions that allow access to the internet. AE = advanced economy; CCA = Caucasus and Central Asia; EM = emerging market; GCC = Gulf Cooperation Council; ME&CA = Middle East and Central Asia; MENA = Middle East and North Africa; OE = oil exporter; OI = oil importer.

Figure 3. ME&CA Countries with CBDC Interest



Source: IMF desk survey.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. CBDC = central bank digital currency; ME&CA = Middle East and Central Asia.

in a CBDC are at the research stage, while a few are at the proof-of-concept[5] stage (Bahrain, Georgia, Saudi Arabia, United Arab Emirates). Kazakhstan is most advanced in its journey to CBDC, having initiated two pilots of the digital tenge (DT; NBK 2021; Handagama 2023). The region's fragile and conflict-affected states (FCSs) and low-income countries (LICs) have expressed limited interest. Three country case studies (Jordan, Kazakhstan, Libya), each at different stages of CBDC exploration, can be found in Annex 4.

Enhancing financial inclusion and domestic and cross-border payment efficiency are among the main CBDC policy objectives in the ME&CA region. The survey indicates that most ME&CA countries, especially those interested in financial inclusion (Azerbaijan, Kyrgyz Republic), are primarily interested in retail CBDCs. Hence, this paper will focus on retail CBDCs. A few countries are exploring wholesale CBDCs with local commercial banks and fintech partners (Saudi Arabia).[6]

The key questions policymakers need to consider when exploring possible CBDC adoption are the following: What objectives do policymakers aim to achieve with a CBDC? Which inefficiencies in payment systems can CBDCs address? What are the implications of CBDC issuance for financial stability, monetary policy pass-through, and central bank operational risk? How can CBDC design help achieve policy objectives and mitigate these risks?

Although there are no clear economic prerequisites to adopting a CBDC, the choice to issue a CBDC is complex and country dependent. Each country has different objectives, payment and financial systems, legal and regulatory frameworks, and central bank capacity. CBDCs are also a relatively new concept, with limited adoption and uptake to date, making it challenging to draw lessons from other countries. Hence, policymakers should approach CBDCs cautiously: successful implementation will require comprehensive analysis. In this respect, the IMF has been helping country authorities evaluate the need to issue a CBDC and establish strong policies and regulatory frameworks through capacity development. As of February 2023, seven ME&CA countries had received IMF capacity development on CBDC. In addition, the institution is leading the way with a significant number of analytical pieces,[7] including a comprehensive CBDC handbook guided by specific country capacity development questions on CBDC-related topics (IMF 2023b) (Box 1).

[5] For a definition, please see Tourpe, Lannquist, and Soderberg 2023.

[6] A CBDC is a digital currency issued by the central bank and accessible by individuals and firms. CBDCs are issued and regulated by the central bank, are denominated in the local currency, and can function as a means of payment and store of value. CBDCs improve convenience over cash by being digital and expanding a country's digital payment options. Unlike private cryptocurrencies, CBDCs are a liability of the central bank and could constitute legal tender. CBDCs can be accessed by individuals and firms ("retail" CBDCs) or select financial institutions ("wholesale" CBDCs). See also Annex 2.

[7] See the IMF FinTech Notes series (https://www.imf.org/en/Publications/fintech-notes).

Box 1. Capacity Development on Central Bank Digital Currencies

The IMF's Digital Money Strategy, which the Executive Board endorsed in July 2021, gives the institution a mandate to help ensure that digital money fosters domestic and international economic and financial stability (IMF 2021a). The IMF has increased its analytical work and capacity development delivery on central bank digital currencies (CBDCs). The objective is to strengthen the capacity of member countries to assess, design, pilot, implement, and supervise CBDCs. Ultimately, both analytical work and capacity development delivery will contribute to country economic and financial stability and the stability of the international monetary system by making country payment systems and macrofinancial frameworks more resilient.

In terms of analytical work, the IMF (2023d) released five chapters of the CBDC Virtual Handbook in November 2023. This handbook is a guide that aims to gather lessons learned and develop frameworks and guidance for member countries. It is meant to be a reference for policymakers and experts at central banks and finance ministries. This major project will generate about 20 chapters over the next five years, with four to five chapters being released per year. The chapter topics are chosen based on country needs and feasibility. The first set of chapters included a decision-making framework, a product development methodology, and implications for financial inclusion, monetary policy transmission, and capital flow management measures. The chapters will be updated regularly to reflect the latest developments and policies related to CBDCs. A second set of chapters will be published in 2024. Potential topics include financial stability; CBDC distribution, incentives, and adoption; cyber security; the relationship between CBDCs and other payment systems; cross-border payments; and implications for data frameworks and privacy protection.

Regarding capacity development, the IMF works with countries through bilateral capacity development and regional workshops. The bilateral capacity development aims to provide tailored, practical, innovative, and technical advice to countries based on solid and thorough analysis and lessons learned from other countries. After capacity development delivery, countries should be better equipped to (1) understand the different uses, designs, ecosystem, and advantages and disadvantages of CBDCs; (2) understand the capacity, processes, and cost requirements involved in exploring and implementing CBDCs; (3) evaluate whether CBDCs are suitable for their economies given their specific goals, challenges, capacities, and the nature of their payment and financial sectors; (4) plan and test different stages of CBDC exploration, including creating prototypes and conducting trials to test specific policies; (5) design policies, such as regulations, to accompany CBDCs and promote financial inclusion and integrity; and (6) understand and prepare for any potential effects that their CBDC or a CBDC from another country may have on their economy. More than 30 bilateral capacity development and regional workshops have taken place, with a quarter of them focusing on Middle East and Central Asia countries. In June 2023, the IMF and Morocco co-hosted a high-level policy discussion on CBDCs to share knowledge and information among Middle East and Central Asia countries.

The IMF has been actively participating in international working groups within the Group of Twenty and the Group of Seven to study how CBDCs can be used for cross-border transfers. They are exploring new ways to improve cross-border payments by analyzing innovative solutions, such as multilateral platforms, that use innovative technology to connect payments between countries using CBDCs and traditional payment systems. The IMF and World Bank have developed an approach to provide technical assistance for cross-border payments. The IMF has identified specific areas where assistance can be most effective in achieving the goals outlined in the Group of Twenty Roadmap for enhancing cross-border payments while safeguarding the integrity of the financial system.

2. CBDC Objectives

What objectives do policymakers hope to achieve by adopting a CBDC? Country authorities have multifaceted reasons for exploring the adoption of CBDCs (see Annex 3 for a complete list debated in the literature). The survey of IMF ME&CA country teams identifies enhancing *financial inclusion* and *payment system efficiency* as the top priorities for exploring CBDCs in the ME&CA region (Table 1).[8]

In Middle East and North Africa (MENA) oil exporters and Gulf Cooperation Council (GCC) countries, the motivation for exploring CBDCs is to make payments more efficient, both domestically and cross-border (for example, Qatar and the United Arab Emirates) (Schickler 2022; Central Bank of United Arab Emirates 2023). In contrast, the top priority in Caucasus and Central Asia (CCA) countries is to increase financial inclusion; improving payment system efficiency and promoting innovation in financial technology are also important objectives in this region. In Georgia, where the focus is on a CBDC's potential to promote financial inclusion, the central bank has been actively researching CBDC capabilities, design, and potential use cases since 2020 and officially launched a limited access live pilot of the digital lari with Ripple Labs through the cutting-edge Ripple CBDC platform (National Bank of Georgia 2023). MENA oil importers (for example, Jordan) also rank promoting financial inclusion and the efficiency of payment systems as key motivations for exploring CBDCs (IMF 2022d).

Several lower-middle-income countries have built national agendas focused on deepening financial inclusion. In June 2021, Uzbekistan's first National Financial Inclusion Strategy (for 2021–23) identified promoting digital payments as a key priority. The Central Bank of Azerbaijan is also promoting digital banking and payments, revising and approving regulation that expands access to remote banking and provides for bank accounts to be opened remotely using digital identification (EBRD 2023).

Table 1. Key CBDC Objectives by Country Group

Country Group	Making Payments More Efficient (cross-border)	Making Payments More Efficient (domestic)	Broadening Access to Payments	Increasing Financial Inclusion
MENA Oil Exporters	✓	✓		
MENA Oil Importers			✓	✓
Caucasus and Central Asia		✓		✓
Low-Income Countries				✓
Gulf Cooperation Council Countries	✓	✓		
Fragile and Conflict-Affected States		✓	✓	
Emerging Markets		✓	✓	

Source: IMF survey to country teams.
Note: CBDC = central bank digital currency; MENA = Middle East and North Africa.

[8] The country teams that participated in the survey are Algeria, Armenia, Azerbaijan, Bahrain, Djibouti, Egypt, Georgia, Islamic Republic of Iran, Iraq, Jordan, Kazakhstan, Kuwait, the Kyrgyz Republic, Lebanon, Libya, Mauritania, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tajikistan, Tunisia, Turkmenistan, the United Arab Emirates, Uzbekistan, West Bank and Gaza, and Yemen.

3. Payment Systems and Benefits of CBDC in ME&CA

Understanding payment systems and their inherent inefficiencies in the region will help ascertain the potential benefits of CBDCs and, specifically, whether CBDCs can help achieve the objectives of ME&CA policymakers to enhance financial inclusion and the efficiency of domestic and cross-border payment systems.

A. Financial Inclusion and Payment Systems in ME&CA

In general, there is a low level of financial inclusion in ME&CA countries, though there is a marked divergence across the region. For example, access to bank accounts in ME&CA countries is lower than the global average, indicating a low level of financial inclusion (Figure 4, panel 1) (Cardarelli, Vera-Martin, and Lall 2022, Blancher and others, 2019). However, access to bank accounts is relatively higher in the GCC, while low-income Middle East, North Africa, Afghanistan, and Pakistan (MENAP) countries have the lowest access. The percentage of the adult population with bank accounts ranges from 6 percent in Sudan to 90 percent in the Islamic Republic of Iran (Figure 4, panel 2). Access to bank accounts appears to correlate with countries' income levels but remains well below the global average.

Similarly, although the adoption of digital payment methods in ME&CA countries is progressing, there is considerable variation, and the region overall is behind other regions (Figure 5).[9] This heterogeneity in digital payment adoption could be attributed to several factors. The impact of the pandemic and the need for economic diversification have driven an increase in digital payments in the GCC countries (Economist Intelligence Unit 2020). Saudi Arabia has the fastest digital payments adoption rate thanks to a comprehensive digital payment strategy under its Vision 2030 development plan.[10] Within the MENA region, there is a wide discrepancy in the adoption of digital payments. Countries like the Islamic Republic of Iran, Saudi Arabia, and the United Arab Emirates have high levels of digital payment usage, with 85 percent, 73 percent, and 77 percent of adults utilizing digital payments in 2021, respectively. In contrast, countries like Iraq and Afghanistan have significantly lower adoption rates at 14 percent and 8 percent, respectively. This disparity in adoption rates may reflect the high cost of existing digital payment systems in some countries, which can exclude certain segments of the population. In the CCA, Kazakhstan is making significant progress in increasing digital payments, with the amount of non-cash payments increasing by 2.5 times in 2021 compared to 2019 (PwC 2023).

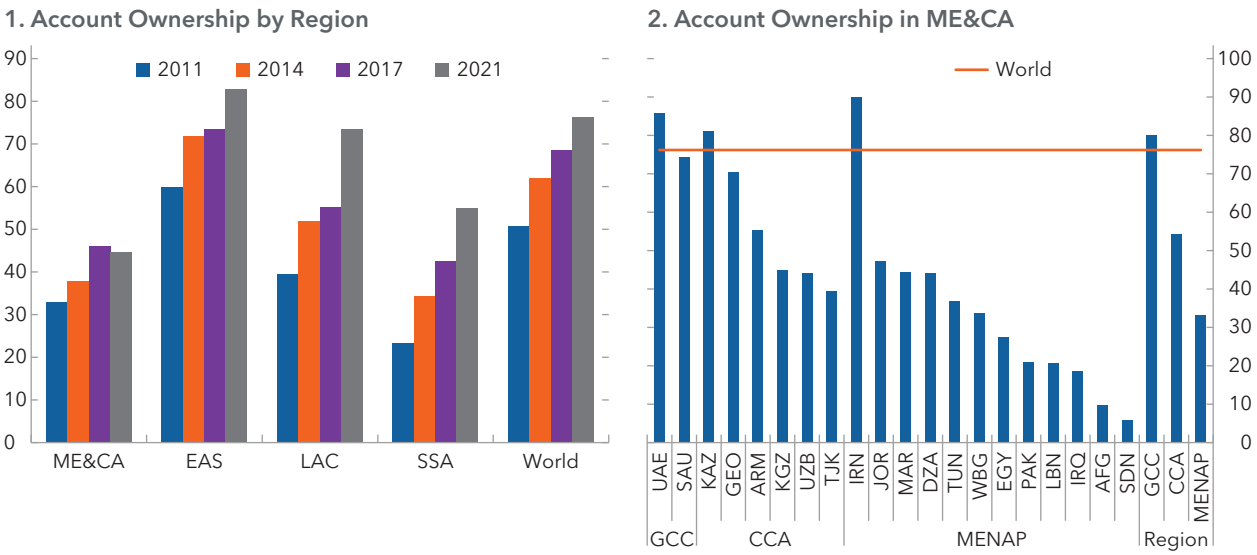
Despite having a digitally savvy population, some ME&CA countries still heavily rely on cash for transactions.[11] Cash in circulation is particularly high in the region's LICs and FCSs (Figure 6). For example, in Iraq and Mauritania, cash in circulation was about 26 percent of GDP in 2021 and 2020, respectively. In contrast, cash in circulation has been declining in the GCC, averaging only 5.4 percent of GDP in 2021, reflecting the region's digital advancement.

[9] Digital payments include the use of a mobile money account, a debit or credit card, or a mobile phone or the internet to make a payment from an account, or the use of a mobile phone or the internet to send money to relatives or friends or to pay bills. Digital payments also include in-store or online merchant payments, paying utility bills, sending or receiving domestic remittances, receiving payments for agricultural products, or receiving wages, government transfers, or a public pension directly from or into an account.

[10] Under Vision 2030, Saudi Arabia aims to have 70 percent of the nation's transactions handled digitally by 2030.

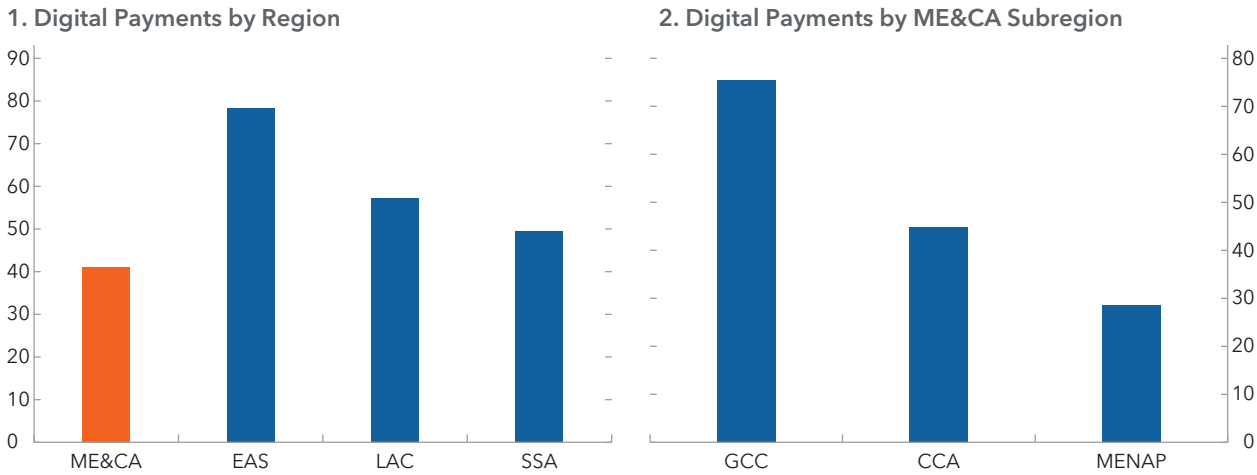
[11] Smartphone penetration in ME&CA reached 88 percent in 2021.This is higher than sub-Saharan Africa (76 percent) and Latin America (75 percent).

Figure 4. Account Ownership, 2021
(Percent of adults over age 15)



Sources: Global Financial Inclusion database 2021; and IMF staff calculations.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. CCA = Caucasus and Central Asia; EAS = East Asian countries; GCC = Gulf Cooperation Council; LAC = Latin America and the Caribbean; ME&CA = Middle East and Central Asia; MENAP = Middle East, North Africa, Afghanistan, and Pakistan; SSA = sub-Saharan Africa.

Figure 5. Digital Payments
(Percent of adults)

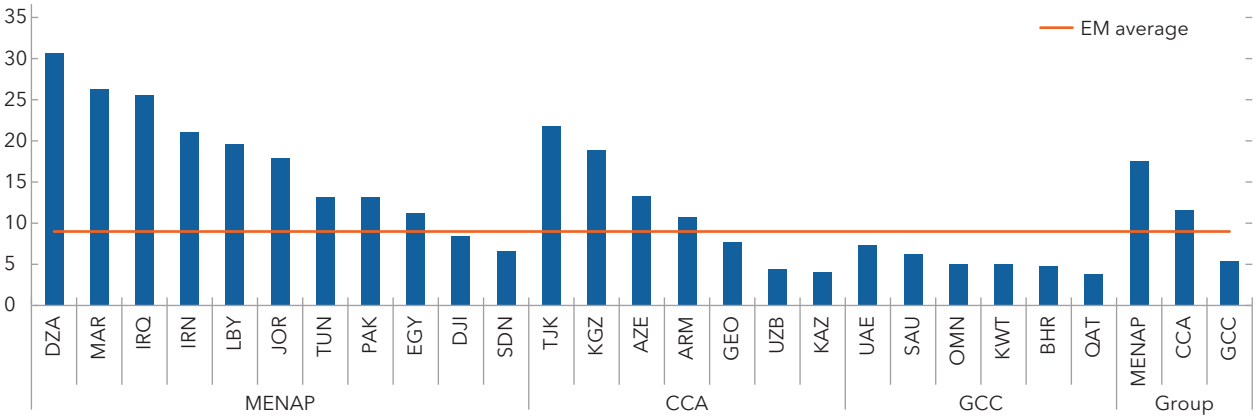


Sources: Global Financial Inclusion database 2021; and IMF staff calculations.
Note: Adults over age 15 making or receiving digital payments. CCA = Caucasus and Central Asia; EAS = East Asian countries; GCC = Gulf Cooperation Council; LAC = Latin America and the Caribbean; ME&CA = Middle East and Central Asia; MENAP = Middle East, North Africa, Afghanistan, and Pakistan; SSA = sub-Saharan Africa.

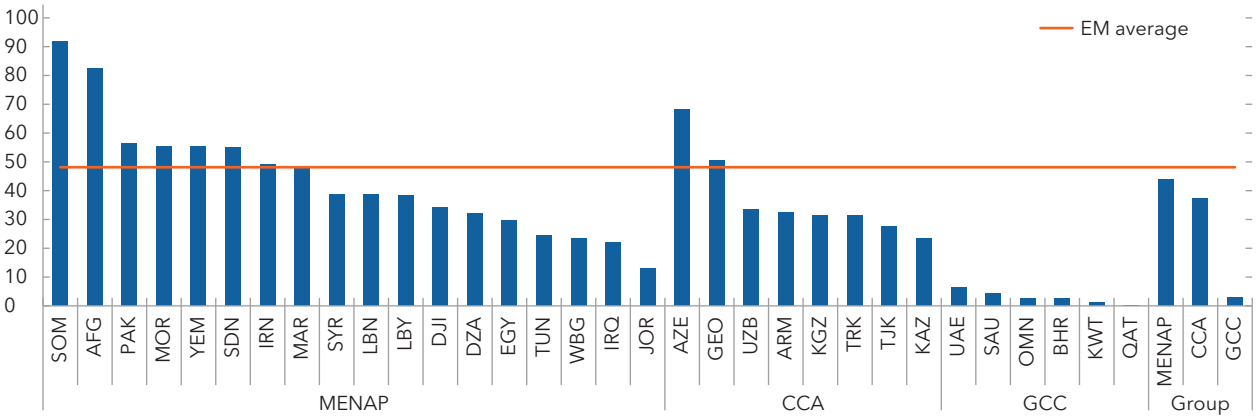
The MENA region depends heavily on cash transactions due to underdeveloped payment systems and high informality (Figure 6, panel 2). The region's informal sector plays a substantial role in the economy, generating about one-third of GDP and employing about 65 percent of the labor force. Only about one-third of retail transactions are conducted electronically in the region. This high reliance on cash is also due to tax and loan debt evasion, concealment of the intended use of money, underbanked consumer and merchant segments, a cultural bias toward cash, low wealth, and lack of trust in financial institutions (Figure 7) (Abidi and others 2023; Gatti and others 2014; Chan and others 2021).

Figure 6. Reliance on Cash in ME&CA

1. Cash Ratios across Countries
(Currency in circulation as share of nominal GDP)

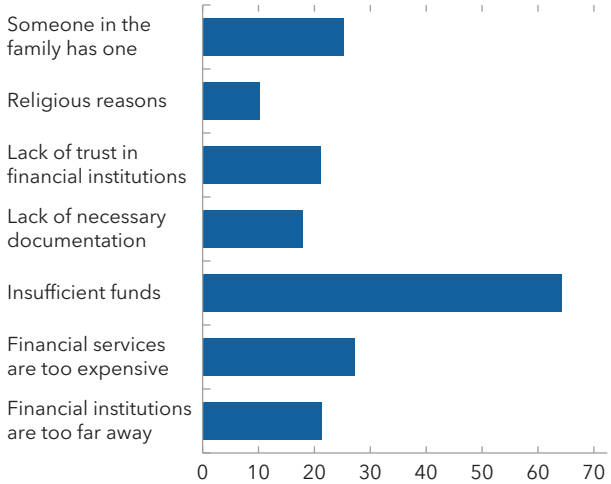


2. Self-Employment, 2020
(Share of total employment)



Sources: Haver Analytics; ILOSTAT database; national authorities; and IMF staff calculations.
Note: Cash ratios are computed as currency in circulation divided by nominal GDP. Data labels in the figure use International Organization for Standardization (ISO) country codes. CCA = Caucasus and Central Asia; EM average = global emerging markets average excluding ME&CA economies; GCC = Gulf Cooperation Council; ME&CA = Middle East and Central Asia; MENAP = Middle East, North Africa, Afghanistan, and Pakistan.

Figure 7. Reasons for Not Holding an Account
(Percent of adults stating reason)

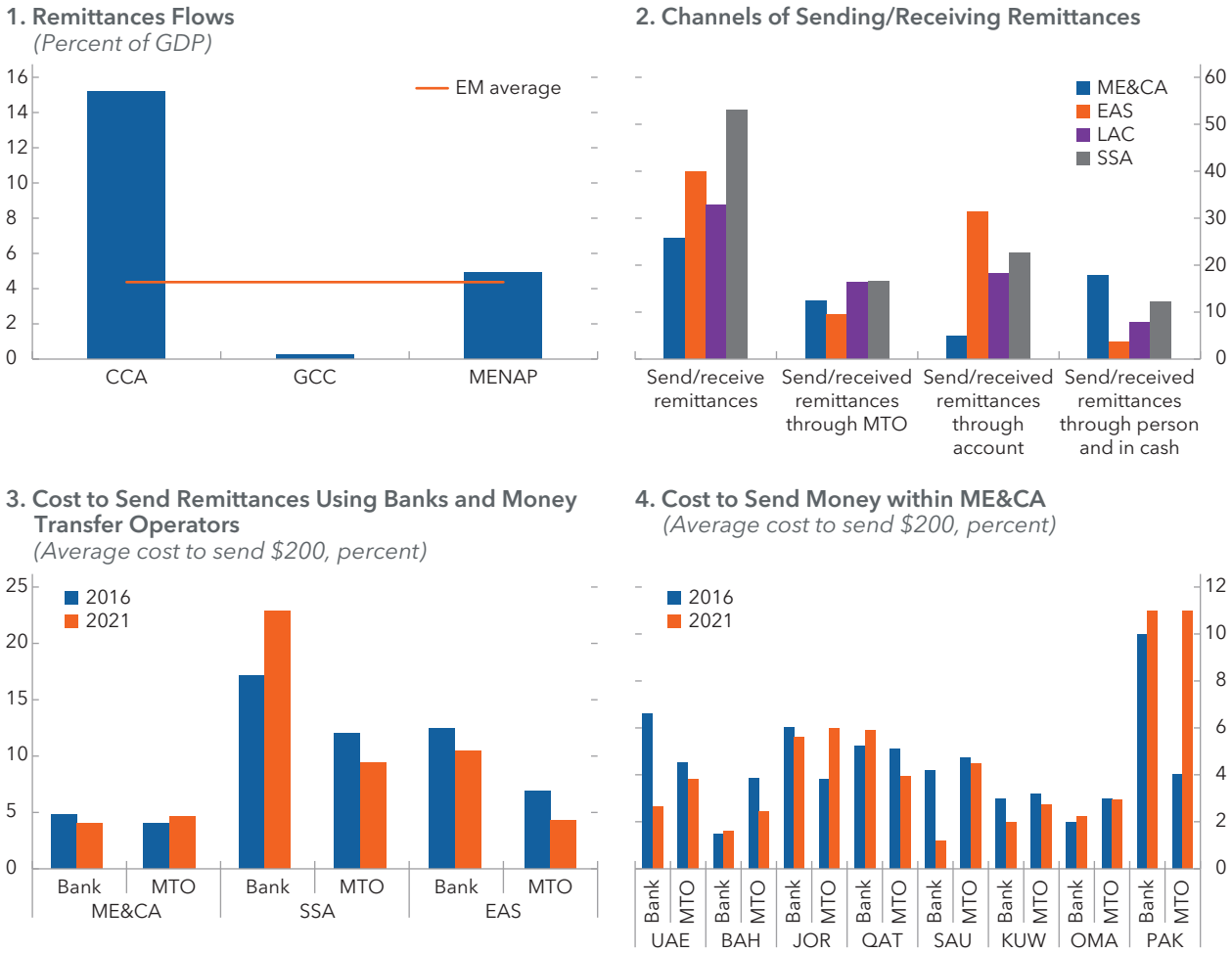


Sources: Global Financial Inclusion database 2021; and IMF staff calculations.

Cash remains the dominant payment instrument for remittances despite the move toward digital payments, rising use of mobile accounts, and lower transaction costs (Figure 8, panel 1). Remittance flows to ME&CA countries reached $447 billion in 2021, dwarfing other high-volume flows such as portfolio investment and official development assistance. However, the most common way to send and receive domestic remittances is still by another person using cash (Figure 8, panel 2).[12] The opposite is true in the Asia Pacific and Latin America regions, where account-based remittance transfers are most common, followed by

[12] This is particularly the case for LICs/FCSs such as Algeria and Djibouti, which explains the overall low average for MENAP.

Figure 8. Remittances in ME&CA



Sources: IMF, Balance of Payments and International Investment Position Statistics database; World Bank, Remittance Prices Worldwide; and IMF staff calculations.
Note: Sent or received domestic remittances: using an account (percent age 15+). Data labels in the figure use International Organization for Standardization (ISO) country codes. CCA = Caucasus and Central Asia; EAS = East Asian countries; EM = emerging markets; GCC = Gulf Cooperation Council; LAC = Latin America and Caribbean; ME&CA = Middle East and Central Asia; MENAP = Middle East, North Africa, Afghanistan, and Pakistan; MTO = money transfer operator; SSA = sub-Saharan Africa.

those from money transfer operators. Cost does not seem to be a key impediment since the cost of remittances across all corridors and providers from the MENA region to receiving countries is below the global and sub-Saharan Africa averages (Figure 8, panels 3 and 4).

B. Benefits of CBDCs in ME&CA

CBDCs can help policymakers achieve their primary objectives of enhancing financial inclusion and payment system efficiency (domestic and cross-border) if they can address the inherent gaps in current systems.

Financial Inclusion

CBDCs have the potential to advance financial inclusion by creating more competition for consumers and allowing for transactions to be settled more directly through reduced intermediation, thereby lowering the cost of financial services and making them more accessible. Unlike commercial banks, the lack of a profit

motive by the central bank can also help keep costs lower. Considering that the financial system in the ME&CA region is heavily bank-dominated with a relatively high profit margin, CBDCs have the potential to advance financial inclusion.

CBDCs could also help enhance the service quality for payment service providers (PSPs) and spur further innovation in the digital payment system by simplifying market entry for PSPs and removing the need for negotiations to access specific payment infrastructures and banking services. Similar effects could be achieved through policy reforms that enable nonbank entities to access central bank accounts and provide risk-based, fair, and transparent access to critical payment infrastructures, as seen in the case of Saudi Arabia and the United Arab Emirates. In addition, given that a CBDC would carry the safety of central bank money and legal tender status, it could help overcome distrust in financial services and broaden access. CBDCs could also provide the needed technological infrastructure from scratch (a "clean slate") if it does not already exist; hence, providing a public good that may be particularly relevant for LICs and FCSs, which may lack such infrastructure and where the share of the underserved population is particularly high.

Payment Systems

CBDCs have the potential to help improve the efficiency of payment systems, both domestic and cross-border. By spurring competition in the domestic payment market, CBDCs can lower costs and update legacy technology platforms. As for cross-border payment systems, these are prone to various frictions, such as fragmented and truncated data formats across regions, complex processing of compliance checks, limited operating hours across jurisdictions, lack of payment system interoperability (due to differences in domestic legislation), and legacy technology platforms. These frictions result in high fees due to multiple intermediaries (correspondent banking) and a lack of guarantee as to whether the funds have been received in full (that is, finality). CBDCs could simplify the intermediation chains and increase availability (as they would operate on a 24/7 basis) by starting a "clean slate" system designed to achieve interoperability between different jurisdictions and allowing for real-time payment service (BIS, IMF, and World Bank 2021). The United Arab Emirates' mBridge project is a good example for aiming to resolve these inefficiencies with wholesale CBDCs.

By improving the efficiency of cross-border payments, CBDCs could also enable the flow of international remittances. This, in turn, can play an essential role in supporting economic development and financial inclusion.[13] CCA and MENA oil-importing economies, considering their high reliance on cash, including for remittances, could reap significant gains from improving the efficiency of domestic and cross-border payment systems. Cheaper and more accessible remittances will benefit senders and recipients, help buffer economic shocks, and stimulate growth.

Despite the potential of CBDCs to improve financial inclusion and improve payments systems efficiency, it is crucial to recognize that CBDCs are not a panacea. Therefore, policymakers should conduct a comprehensive analysis of the various alternatives as some of the benefits of CBDCs could be achieved through other means. For example, facilitating the entry of new players in the market and providing comprehensive regulation and supervision of the entities to uphold the stability and integrity of the payment system can also improve competition. Increased competition could also occur through improved access to central bank accounts by PSPs, to avoid intermediaries in payment services provision.

CBDCs may also not be able to overcome existing barriers to financial inclusion, such as those due to limited identification and financial literacy, low wealth, and high informality, which tend to be associated with a strong preference for physical cash. Regarding cross-border payments, some regional initiatives are already addressing inefficiencies by fostering payment system interoperability. Specifically, the GCC Real-Time

[13] Remittances are usually the first financial service used by migrants and their families, thus providing a point of contact with the financial sector that can be leveraged to increase access to other financial services.

Box 2. Improving Cross-Border Payment Systems

Gulf Cooperation Council (GCC) Real-Time Gross Settlement System (RTGS)
Led by the six central banks of the GCC (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates)

What will it do? The GCC RTGS will provide an overarching regional payment system connecting the individual domestic RTGS payment systems of each of the six GCC countries, enabling an efficient delivery of intra-GCC payments in the fiat currencies of the six countries. For example, a Saudi riyal payment originated in the United Arab Emirates and destined for a beneficiary in Saudi Arabia would occur over the domestic United Arab Emirates and Saudi Arabian payment systems, instead of relying on bilateral correspondent banking frameworks.

What are the benefits? The GCC RTGS would create standardization, drive efficiency, bring predictability, and reduce costs, as cross-border payments would previously be delivered using domestic payment system architecture. This would bring the experience of a pan-regional cross-border payment closer to that of a domestic payment.

Arab Regional Payment System (known as BUNA)
Led by the Arab Monetary Fund

What will it do? The system aims to create a central routing agent to provide a standardized payment experience across the Arab countries. With a common set of operating rules and a standardized SWIFT platform, BUNA would bring together the markets of the GCC and the Middle East and North Africa for all intraregional payments, covering not just the fiat currencies of the Arab countries but also key principally traded currencies such as the US dollar and euro.

What are the benefits? Already "live" with the Emirati dirham, Egyptian pound, and Saudi Arabian riyal, BUNA is looking to augment currencies, countries, and commercial bank participation over the near to medium term to provide efficiency and standardization to intraregional cross-border payments. Soon, BUNA aims to enhance the platform further by introducing instant and real-time delivery of pan-regional cross-border payments and providing the foundation to support other financial market infrastructure.

Sources: Arab Monetary Fund; and Chan and others (2021).

Gross Settlement (RTGS) and the Arab Regional Payment System aim to streamline intraregional payment flows and improve the cross-border payment ecosystem (Box 2). In addition, CBDCs could coexist with other payment systems already in place and are not an either/or solution.

4. Financial Systems and Financial Stability Implications of CBDCs in ME&CA

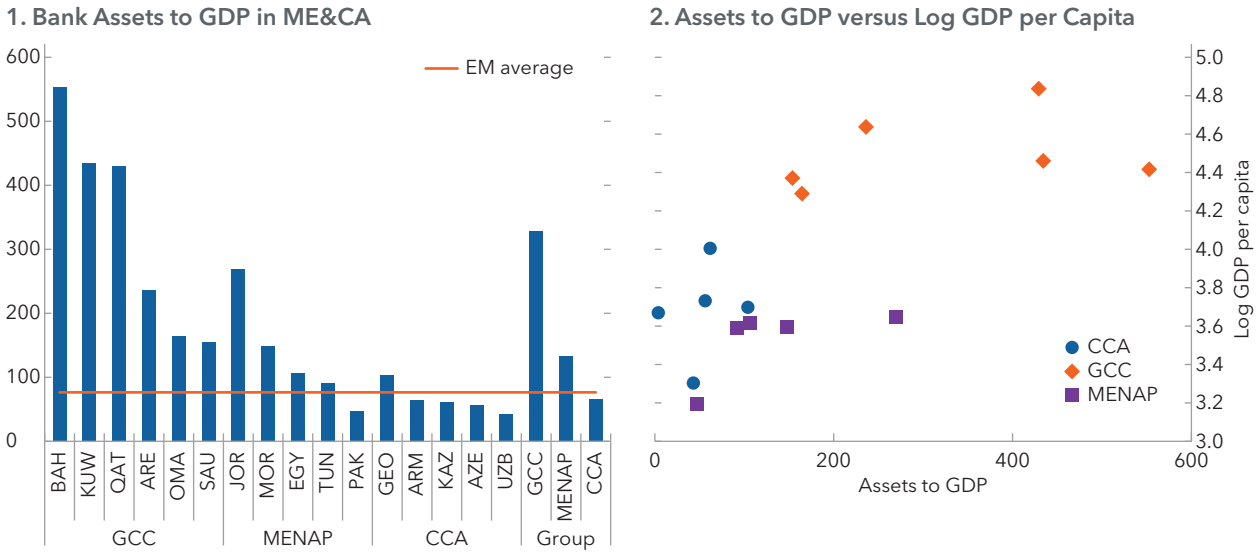
Understanding ME&CA financial systems will help to ascertain how CBDCs may affect financial stability in the ME&CA region. The relatively healthy financial systems in the region could support CBDC adoption. However, a country-specific analysis is paramount, including given the heterogeneity of financial systems across the region.

A. ME&CA Financial Systems

ME&CA financial systems are primarily dominated by banks (Figure 9). Nonbank financial institutions—pension funds, asset management and finance companies, and insurance—are underdeveloped in the region and are generally not involved in credit intermediation. Banks' total assets reached $2.4 trillion in 2021 (185 percent of GDP), up from $1.7 trillion in 2016 (149 percent of GDP).[14,15] Still, there is significant heterogeneity across the region.

- In the GCC, financial systems are large, having grown in recent years thanks to buoyant economic activity fueled by large hydrocarbon proceeds and abundant liquidity. At the end of 2021, banks' lending to GDP reached $2.7 trillion (or 198 percent of non-oil GDP) compared to other emerging markets (44 percent of GDP). Bahrain (the smallest GCC economy) ranks first in terms of banking system size with a ratio of banking system assets to non-oil GDP of 552 percent, while Saudi Arabia (by far the largest economy in the region) has the smallest ratio of banking system assets to non-oil GDP of 100 percent.

Figure 9. Bank Asset Structure in ME&CA

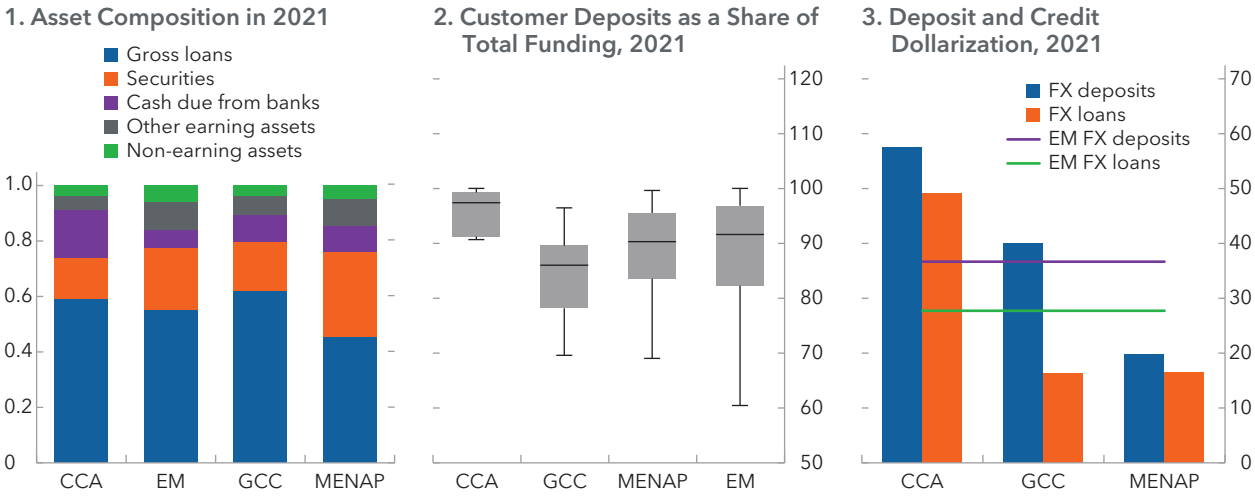


Sources: Fitch Connect; and IMF staff calculations.
Note: Figure uses 2021 values. Data labels in the figure use International Organization for Standardization (ISO) country codes.
CCA = Caucasus and Central Asia; EM = emerging markets; GCC = Gulf Cooperation Council; ME&CA = Middle East and Central Asia; MENAP = Middle East, North Africa, Afghanistan, and Pakistan.

[14] Non-oil GDP is used for oil exporters.

[15] For 2021, the share of assets to GDP for other emerging markets amounts to 74 percent of GDP.

Figure 10. Banking Structure in ME&CA



Sources: Fitch Connect; and IMF staff calculations.
Note: CCA = Caucasus and Central Asia; EM = emerging markets; FX = foreign exchange; GCC = Gulf Cooperation Council; ME&CA = Middle East and Central Asia; MENAP = Middle East, North Africa, Afghanistan, and Pakistan.

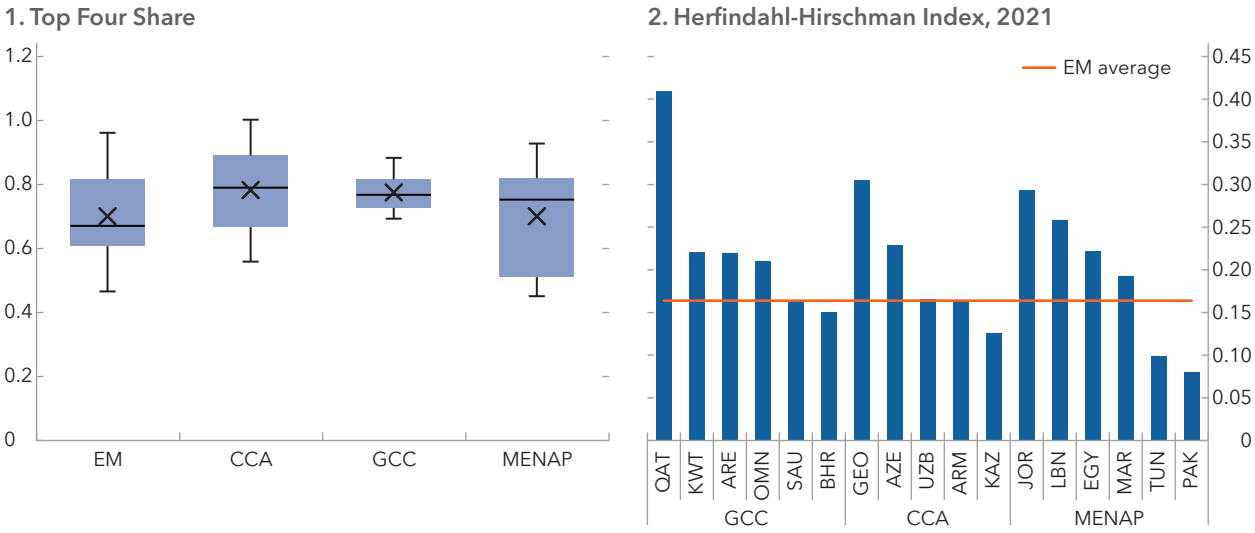
- Financial sectors in the CCA region are relatively small and underdeveloped. Georgia has the largest banking sector in the region and is close to the global average of emerging markets, as measured by banking system assets to GDP. In contrast, Azerbaijan, Kazakhstan, and Uzbekistan have relatively small banking sectors, less than half the size of the average banking sector in the region.

- Banking systems in the MENAP region are relatively heterogeneous. Jordan and Morocco have the largest banking sectors within this subregion. Despite the relative size of the economy, Pakistan's banking sector is relatively small (47 percent of banking system assets to GDP).

Demand deposits constitute a large share of funding for banks in the ME&CA region (around 83 percent in 2021). On the liability side, banks' funding is largely deposit-based and close to the emerging market average (80 percent). In contrast, wholesale funding is low in the region (5 percent of total funding), ranging from 3 percent in the CCA to 6 percent in the MENAP region. Lending accounts for the bulk of banking assets in the ME&CA region (Figure 10). In the GCC, loans amount to more than half of assets, with average annual loan growth of about 6 percent during 2014–20. Banks' holdings of securities, typically government bonds, in the GCC slightly increased by 12 percent over the same period. The ratio of banks holding of government securities to credit to the private sector is the highest in Saudi Arabia and the United Arab Emirates, which also display a relatively high share of government ownership compared to other GCC countries (IMF 2021b). While banks in the CCA also display an increase in government securities over 2014–20 of about 9 percent of bank assets (17 percent in Kazakhstan, 10 percent in Armenia, and 8 percent in the Kyrgyz Republic), holdings of equities and corporate bonds remain negligible, given undeveloped capital markets. They also display higher holdings of cash. Within MENAP, bank holdings of government bonds make up a significantly higher proportion of their assets, particularly in Egypt and Pakistan where government bonds make up more than 40 percent of banking system assets.

The banking sectors in ME&CA economies are relatively concentrated, with low banking competition and a significant state-owned bank footprint (Figure 11). In 2021, the top four banks (ranked by assets) held about 72 percent of total assets, slightly above other emerging markets (65 percent of assets). Government ownership of banks is also prevalent, particularly in Egypt, Pakistan, and Saudi Arabia (ranging from about 50 percent in Egypt and Saudi Arabia to 28 percent in Pakistan in 2021), hampering banking sector competition.

Figure 11. Bank Concentration in ME&CA



Sources: Fitch Connect; and IMF staff calculations
Note: The Herfindahl-Hirschman Index is calculated by summing the squares of the banks' market shares. Figure uses 2021 values. Data labels in the figure use International Organization for Standardization (ISO) country codes. CCA = Caucasus and Central Asia; EM = emerging markets; GCC = Gulf Cooperation Council; ME&CA = Middle East and Central Asia; MENAP = Middle East, North Africa, Afghanistan, and Pakistan.

- The GCC region displays the largest asset concentration, followed by the CCA. In all six GCC countries, the banking sector is dominated by large banks, with the top four banks accounting for about 70 (Saudi Arabia) to 88 percent of total assets (Qatar). In comparison, bank concentration in MENAP is similar to the world emerging market average at about 62 percent of system assets in 2021.
- The picture looks similar using other indicators that signal increased market power. The Lerner index[16] shows an upward trend in the market power of banks in the region until the pandemic.[17] The market power of banks is hovering at high levels across the region, particularly in the MENAP region, reflecting a shallow banking system and the presence of large state-owned banks in some countries limiting competition.

Banks display ample profitability supported by high lending-deposit spreads (Figure 12). The average return on equity in the region stood at 14 percent in 2021—slightly above the emerging market average of 12 percent– ranging from 20 percent in the CCA to 10 percent in MENAP. Within the region, the CCA displays the highest spread between lending and deposit rates (above other emerging markets).[18] At around 9 percent, spreads are particularly high for Azerbaijan, Kazakhstan, and the Kyrgyz Republic. In contrast, spreads in the GCC and MENAP are lower than those in emerging markets in general.

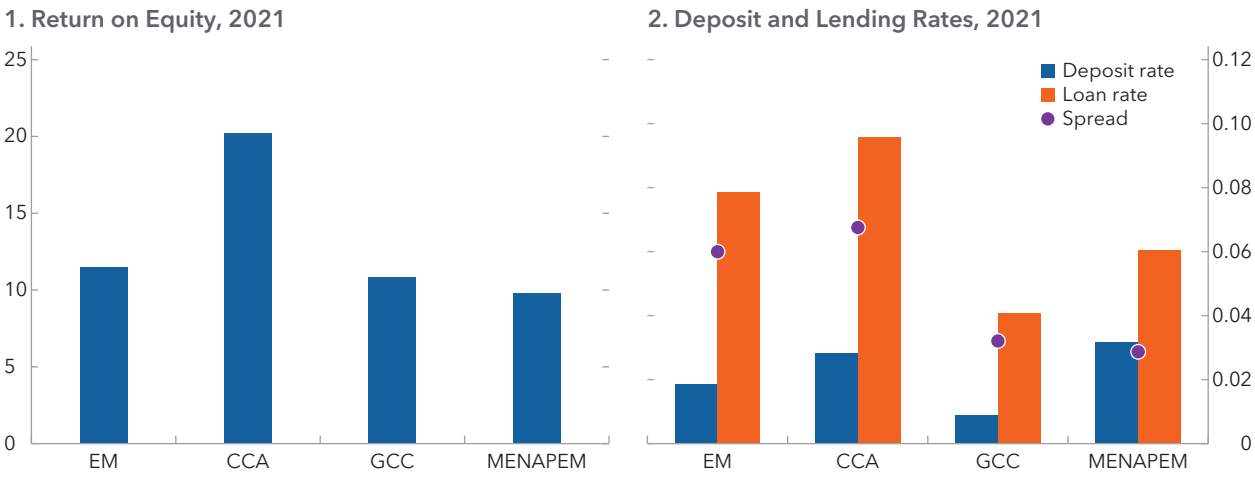
High net interest income also supports profitability (Figure 13). Net interest income accounts for 60 percent of banks' income, with non-interest income (such as from fees and commissions) accounting for about 12 percent in 2021 across the region. Despite a relatively low spread between lending and deposit rates in the

[16] The Lerner index is the difference between price and marginal cost, expressed as a share of the price. The price is captured by the share of income to assets, while the marginal cost is estimated from a translog cost function which includes deposits, wages, and other expenses as inputs.

[17] Following Igan and others (2021), we aggregate bank-level indices using bank assets as weights to construct the Lerner index at the country level, that is, the country-level index is an asset-weighted average of bank-specific Lerner indices. To ensure that the aggregated index does not paint a misleading picture due to changes in the composition of the bank-level data set and accurately represents a country's banking system as opposed to a very small number of banks, we impose two restrictions: first, the bank sample used for a country should be balanced; second, there should be at least 10 banks in a given country in any given year.

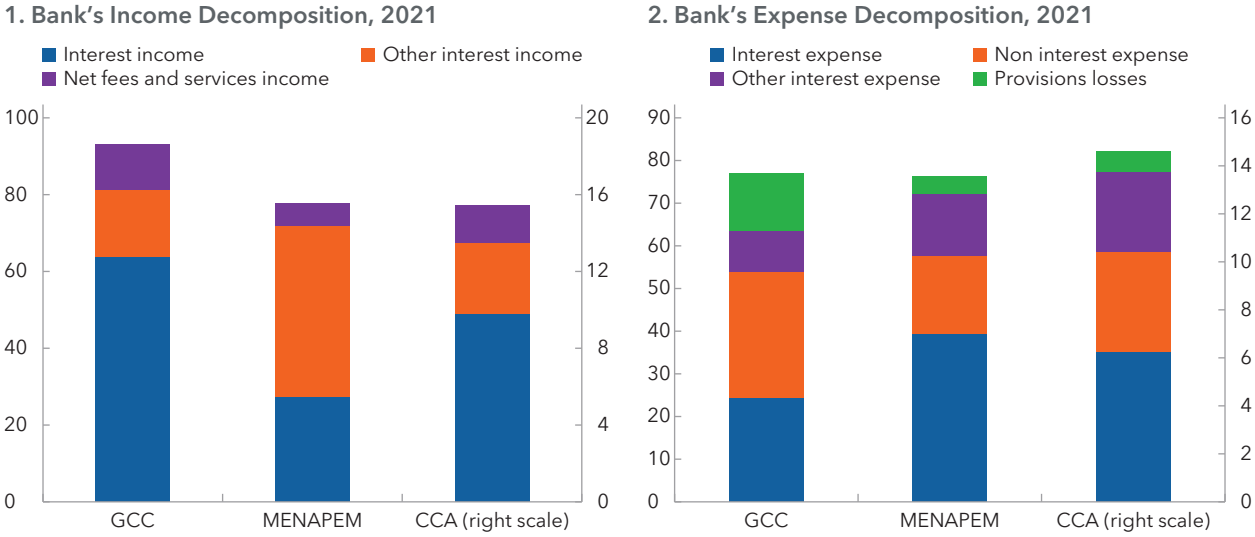
[18] While a high interest rate spread can indicate a lack of competition and efficiency, it can also reflect borrower risk and default in the absence of available credit information. The intermediation spread is, therefore, influenced by various market imperfections and risks.

Figure 12. Bank Profitability in ME&CA



Sources: Fitch Connect; and IMF staff calculations.
Note: CCA = Caucasus and Central Asia; EM = emerging markets; GCC = Gulf Cooperation Council; ME&CA = Middle East and Central Asia; MENAPEM = Middle East, North Africa, Afghanistan, and Pakistan emerging markets.

Figure 13. Bank Income and Expense Decomposition in ME&CA
(Billions of US dollars)

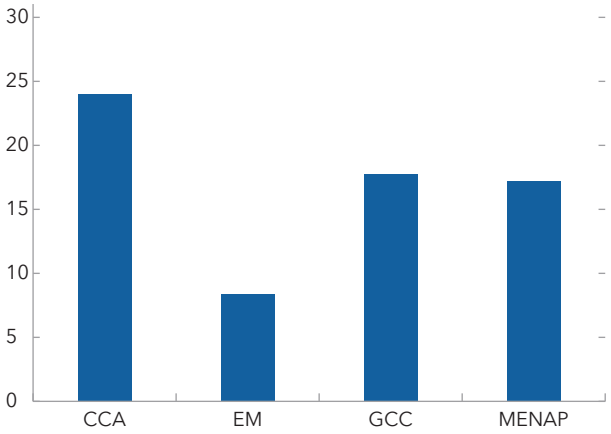


Sources: Fitch Connect; and IMF staff calculations.
Note: CCA = Caucasus and Central Asia; GCC = Gulf Cooperation Council; ME&CA = Middle East and Central Asia; MENAPEM = Middle East, North Africa, Afghanistan, and Pakistan emerging markets.

GCC, net interest margins remain comfortable due to a banking structure with low wholesale funding and a large share of non-interest-bearing deposits (resulting in relatively low interest expenses) of 30 percent of banks' total expenses on average compared to 43 percent in the CCA.

Banking system liquidity is generally abundant in the ME&CA region (Figure 14). In the GCC, excess liquidity—defined as cash held by a bank above the reserve requirement—is high for banks at about 31 percent (as a share of assets) in 2021, significantly above MENAP (7.3 percent) and CCA countries (5.2 percent). Excess liquidity in the GCC, mainly driven by oil price fluctuations, is highest in the United Arab Emirates. While banks typically want to hold a certain level of liquidity for payment and precautionary purposes, excess liquidity can generate an undesired divergence with policy rates and impede monetary policy transmission. In general, too abundant (scarce) liquidity leads banks to offer (borrow) funds through the interbank

Figure 14. Liquid Assets as Share of Total Assets across ME&CA Subregions



Source: Fitch Connect; and IMF staff calculations.
Note: Figures use 2021 values. CCA = Caucasus and Central Asia; EM = emerging markets; GCC = Gulf Cooperation Council; ME&CA = Middle East and Central Asia; MENAP = Middle East, North Africa, Afghanistan, and Pakistan.

market, entailing downward (upward) pressures on interbank rates due to too little (too much) money demand, hence generating an undesired divergence with policy rates and impeding the monetary policy transmission mechanism (IMF 2017).

B. Financial Stability Implications of CBDCs

Strong supervisory frameworks should be ensured to mitigate potential financial stability risks from CBDCs. In general, the healthy capitalization and liquidity buffers of ME&CA banks would support their resilience in adopting a CBDC, but a CBDC can pose broader risks to financial stability.[19] Introducing a CBDC, especially a remunerated CBDC, could lead to a loss of deposits in the banking system. Banks could react by increasing the remuneration of deposits or raising more wholesale funding. Both would imply a reduction in profitability. However, capital buffers in the region are generally strong. Specifically, Tier 1 capital ratios strengthened in the years before the pandemic and remain significantly above regulatory requirements, hovering between 18 percent in the CCA and GCC and 16 percent in MENAP, close to other emerging markets. As mentioned, liquidity buffers are significant (liquid assets as a share of total assets are 22 percent in 2021). However, in some countries, the strong bank-sovereign nexus, low asset quality, and high reliance on foreign deposits could pose financial stability risks. Specifically:

- *Bank-sovereign nexus.* Given large domestic sovereign bond holdings in the region, which receive a zero-risk weight toward the Tier 1 capital ratio, Tier 1 capital ratios may paint an excessively sanguine picture. This concern particularly applies to Egypt and Pakistan where sovereign bond holdings are above 40 percent of total banking assets. Hence, asset revaluation or forced sales of fixed income securities may expose banks to capital losses.

- *Asset quality.* Overall, nonperforming loan ratios remain close to the emerging market average at the end of 2021 and elevated in some CCA and MENAP emerging market and middle-income economies. In the CCA, nonperforming loan ratios declined from over 13 percent in 2018 to 7 percent in 2021 in the aftermath of the 2015–16 financial crisis. In contrast, nonperforming loan ratios remain low in the GCC (roughly 4 percent of total loans) but with significant heterogeneities across countries (ranging from Saudi Arabia at 2 percent to the United Arab Emirates with about 7 percent in 2021).

- *Foreign funding.* Banks in Qatar, and to a lesser extent in the United Arab Emirates, have notable exposures to foreign deposits, which could be more prone to withdrawals in case of financial market stress.

A Model Application: Financial Stability and Monetary Policy Pass-through

How could the issuance of a CBDC interact with ME&CA's financial and monetary systems? This section analyzes financial and monetary implications from a theoretical perspective and zooms in on the ME&CA region by drawing on the results from a small structural model estimated for three countries that reflect the

[19] Chapter 3 provides a more detailed discussion on potential financial stability risks from CBDCs.

region's heterogeneity. The analysis finds that the introduction of unremunerated CBDC has the potential to accelerate the move away from cash and spur competition among banks but is unlikely to impact the pass-through of monetary policy as it does not compete with deposits. However, CBDC is a relatively new concept with limited adoption; hence, it is important to exercise caution and carefully analyze the possible impact of CBDC adoption on financial and monetary systems.

The macrofinancial implications of a CBDC will depend on the extent to which it competes with bank deposits, whether it is remunerated or unremunerated, and whether it will result in banks aligning deposit rates closer to policy rates, thereby strengthening monetary policy transmission (see Chiu and others 2023; Meaning and others 2021). The focus here is on unremunerated CBDCs and the analysis does not delve into the impact of CBDCs on monetary policy transmission, given a range of possible complex transmission channels. Rather, the discussion considers the narrower implications of CBDCs on financial stability and monetary policy pass-through, together with a preliminary analysis of these risks for ME&CA countries. Finally, operational risks for the issuing central bank are also discussed.

Financial Stability

The financial stability implications of CBDCs will depend on the structure of the financial system and CBDC design. The degree of competition, funding structure, and health of the banking system (profitability and liquidity) play an important role in determining the impact of a CBDC. The design of CBDCs—especially their characteristics in terms of access and remuneration—also play a key role and are discussed in detail in the last section of the paper. Here, we focus on implications and mitigation of financial stability risks.

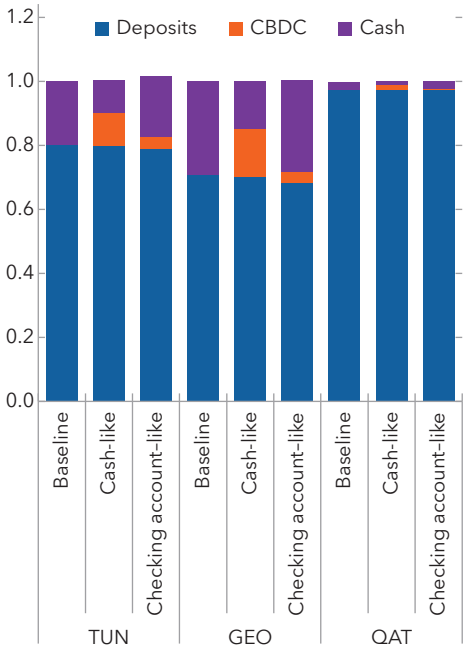
An unremunerated CBDC has the potential to reduce the share of cash and diversify payment systems in ME&CA while the overall impact on financial stability for countries in the region is likely to remain small but depends on the extent to which CBDC competes with bank deposits. CBDCs are a safe asset that can be used for purchases. As such, they can compete directly with other safe assets that households use for transactions, including cash and bank deposits. With the introduction of CBDCs, banking system deposits could decrease as people use CBDCs for their transactions. In the extreme, consumers could close their checking accounts if CBDCs efficiently provide for all household spending needs.

Although the possibility that CBDCs can disintermediate banks has been widely discussed, this is not a foregone conclusion for several reasons. First, banks provide more services than just payment services through deposit accounts (lending, wealth management), so it is not clear that households would want to close their bank accounts. Second, banks can react to the introduction of CBDCs by raising rates on deposits to stem deposit outflows.[20] The impact of introducing unremunerated CBDCs on the quantity of deposits in highly deposit-reliant ME&CA banking systems is, therefore, ambiguous. In those ME&CA countries with highly concentrated banking systems and elevated deposit-lending rate spreads, the additional competition for deposits from CBDCs may be desirable to mitigate bank market power and ensure competitive deposit and lending rates. While this paper focuses on unremunerated CBDCs, Annex 5 illustrates different degrees of remuneration scenarios applied to three country cases using a structural model.

Model estimates show that introducing unremunerated CBDCs in three ME&CA countries would impact the banking systems by attaining a share between 1 and 10 percent of the total money supply. Using the model by Gross and Letizia (2023), we quantify the impact of introducing an unremunerated CBDC on the banking systems in three ME&CA countries that represent the broad country characteristics of the region. Namely we select one emerging market (Tunisia), one highly developed financial system with a low share of cash (Qatar), and one CCA economy with substantial cash usage and elevated dollarization (Georgia). The simulations consider three scenarios: the current baseline without a CBDC, an unremunerated "cash-like"

[20] For instance, Chang and others (2023) highlight that in certain circumstances, the increase in deposit rates may attract higher volumes of deposits, which could more than offset the initial decline in deposits from introducing a CBDC.

Figure 15. Composition of M2 Money Supply
(Current baseline versus simulation)



Source: IMF staff calculations.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. CBDC = central bank digital currency.

CBDC that consumers consider a close substitute to cash, and an unremunerated "checking account–like" CBDC that is like unremunerated deposits in a checking account.

An unremunerated CBDC could attain a significant share of the total money supply, particularly in cash-reliant economies. In the highly cash-reliant economies of Georgia and Tunisia, an unremunerated cash-like CBDC would attain a share of close to 10 percent in total money (Figure 15). For Qatar, the impact of a cash-like CBDC is small because the baseline cash-to-M2 ratio stands at 2.18 percent, and an unremunerated cash-like CBDC would only substitute for a small share of the total money supply (about 1.1 percent). An unremunerated checking account–like CBDC would attain a smaller share of total money (3.5 percent in Georgia, 0.3 percent in Qatar, and 3.5 percent in Tunisia) because remunerated deposits remain more attractive, while a checking account–like CBDC is also a less good substitute for cash. Across the different scenarios, an unremunerated CBDC has a negligible impact on the share of deposits in total money, so bank profitability would not be directly affected, and the impact on the banking sector would be small.

CBDCs that compete with bank deposits may also impact bank funding sources. To the extent that the introduction of CBDCs may compete with bank deposits to some degree and decrease their funding, banks may face short- and longer-term balance sheet challenges. In the short term, as some depositors move toward CBDCs, banks will need reserves to comply with depositor requests. In case reserves run short, banks will need to access refinancing operations at the central bank. However, ME&CA banking systems are characterized by structural excess liquidity (Figure 14), especially the GCC, and banks may have less need to tap into refinancing operations at the central bank.

In the long term, as deposit funding decreases, banks would either need to shrink their balance sheet, with broader implications for lending capability, or substitute funding with other sources. A first option for banks would be to increase the financing from the central bank. This could imply a larger balance sheet for the central bank—with implications for seigniorage—and a larger footprint of the central bank in economic intermediation. As highlighted by Gust, Kim, and Ruprecht (2023), such a scenario would only occur if CBDCs compete for deposits and demand for CBDCs is high. Another option to offset a potential decline in deposits is to raise more equity funding. This would stabilize banks as it reduces leverage and, thus, reduce financial stability risks at the expense of banks' profitability. Finally, banks could substitute toward less stable and usually more costly wholesale funding. However, the role of wholesale funding remains limited in most ME&CA countries.

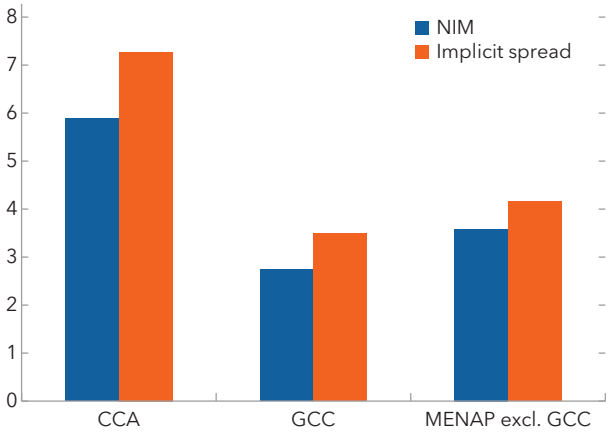
If CBDCs impact bank funding sources in deposit-reliant ME&CA banking systems, there could be implications for profitability depending on banks' market power and lending volumes. Higher deposit rates or substitution toward other more expensive funding sources to stem the competition from CBDCs could reduce banks' net interest margins unless lending volumes or lending rates rise. Banks' net interest margins are, on average, 2.7 percent in the GCC, 3.6 percent in MENAP (excluding the GCC), and 5.9 percent in the CCA in 2022 (Figure 16).[21] Depending on their market power, banks could adjust lending rates to

[21] While GCC banks have lower net interest margins than non-GCC MENAP banking systems, GCC banks also have lower loan losses and lower costs resulting in a higher return on assets for GCC banks than for non-GCC MENAP banks

compensate for the increased costs incurred from higher deposit lending rates. However, this could lower the demand for loans. The higher a bank's market power, the more able it is to pass on these costs and increase lending rates. Banks without market power may be unable to adjust lending rates much, likely resulting in reduced lending volumes and compressing their profitability.

Finally, if CBDCs lead to lower physical cash usage, banks may also be able to reduce the costs associated with cash handling (for example, reducing in-person branches), improving their overall profitability. Cash operations have been estimated to account for between 5 and 10 percent of total banking operating costs, suggesting the potential for significant cost savings from lower cash handling. Since ME&CA banking systems are profitable and well-capitalized on average, these buffers can likely absorb potential adverse impacts on their profitability and capital of introducing CBDCs. Hence, central banks need to assess the health of the banking system and address any vulnerabilities before considering adopting a CBDC.

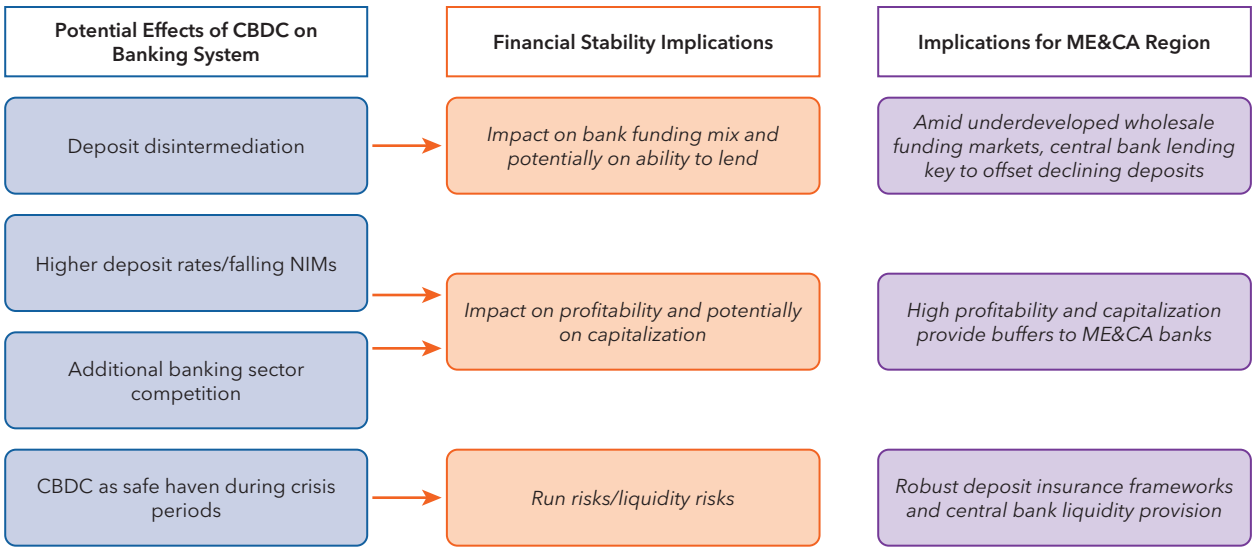
Figure 16. Net Interest Margins and Lending-Deposit Rate Spreads in ME&CA, 2022
(Percent)



Sources: Fitch Connect; and IMF staff calculations.
Note: Implicit spread is computed as the difference between implicit lending rate (interest received on loans divided by total loans) and implicit deposit rate (interest expenses on deposits divided by deposits). CCA = Caucasus and Central Asia; GCC = Gulf Cooperation Council; ME&CA = Middle East and Central Asia; MENAP excl. GCC = Middle East, North Africa, Afghanistan, and Pakistan excluding the GCC; NIM = net interest margin.

Introducing CBDCs could also have an impact on liquidity. During financial turmoil, CBDCs could be perceived as a haven by offering a safe and liquid alternative to bank deposits and thus increase the risk of bank runs (Figure 17). Therefore, having a healthy banking system with a credible deposit insurance system

Figure 17. Implications of CBDC Implementation



Source: IMF staff.
Note: The figure illustrates select channels through which a CBDC could affect financial stability, focusing on channels closely connected to the analytical model. CBDC = central bank digital currency; ME&CA = Middle East and Central Asia; NIMs = net interest margins.

in place, adequate capital and liquidity buffers, and a robust regulatory and supervisory environment is important before considering adopting a CBDC. In case access to CBDCs is open to foreigners and capital flow management measures are not in place, the convenience and safety of foreign CBDCs could also lead to currency runs when countries experiencing difficulties could see capital flee for the foreign CBDCs.[22]

In ME&CA countries, introducing unremunerated CBDCs could help reduce the heavy reliance on cash and diversify payment systems. CBDCs have the potential to accelerate the transition to electronic payments by reducing cash use. This could also allow market entry by new financial service providers in the payment services markets, enhance the competition among payment system providers, and lower associated fees (for example, credit card transaction costs for users and merchants). Additional payment systems options could also affect currency composition in dollarized economies (for example, in the CCA), but this will depend on the reasons for dollarization. In countries where dollarization is driven by low trust in the domestic currency or domestic institutions, CBDCs may be subject to the same adoption challenges as the domestic currency.[23]

Monetary Policy Pass-through[24]

CBDCs could strengthen monetary policy pass-through into deposit rates in ME&CA countries by increasing competition and reducing the banking system's market power.[25] Many banking sectors in the ME&CA region are highly concentrated, implying that deposit rates adjust slower with policy rates than lending rates. In addition, since some GCC countries have a sizable share of non-interest-bearing deposits, it also further mitigates monetary policy pass-through. If an unremunerated CBDC competes for deposits, say due to the added convenience and liquidity attributes, this would, in turn, reduce bank market power, albeit in varying degrees. Moreover, if some customers prefer a CBDC over non-interest-bearing deposits, this may lead to banks raising deposit rates to offset a funding shortfall.

CBDCs have the potential to strengthen the bank lending channel of monetary policy. If banks' cost of funding becomes more sensitive to the policy rate, banks may increase pass-through from policy rates into lending rates and credit provision.[26] This would strengthen the bank lending channel of monetary policy. As highlighted by Meaning and others (2021), however, these forces may be mitigated by lower net interest margins after a CBDC is introduced. As bank capital grows more slowly, this would constrain banks' ability to lend and thus weaken the bank lending channel.

The extent to which unremunerated CBDCs can strengthen monetary policy pass-through in practice will depend on country characteristics. Impediments to monetary policy pass-through in the region—in addition to the degree of dollarization—are low levels of financial market development, a large footprint of state-owned enterprises, and subsidized lending schemes, among other things (IMF 2023a). While CBDCs can potentially strengthen the bank lending channel of monetary policy, such effects may be mitigated in the presence of these other impediments to monetary policy pass-through. In normal times, the effects are expected to be relatively small (Das and others 2023).

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[22] For a discussion of capital flow management measures and CBDC, see He and others (2023).

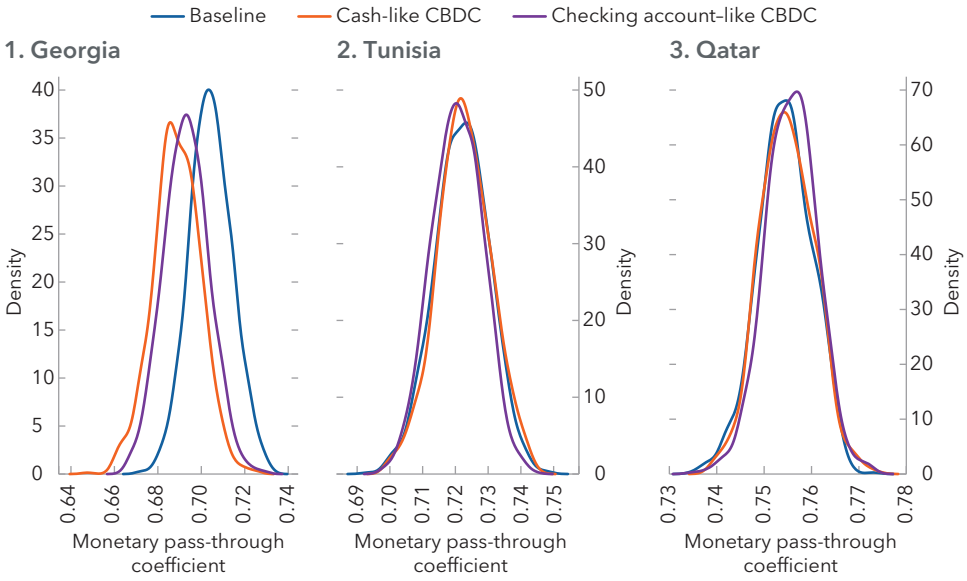
[23] On currency substitution and CBDC, also see IMF (2020).

[24] Central banks should carefully consider a CBDC's potential implications for monetary policy transmission. The issuance of retail CBDCs can impact key parts of countries' macroeconomic environment. In turn, these changes in the macroeconomic environment may affect both the tightness of financial conditions (upon issuance) and the transmission of monetary policy. The change in the macroeconomic environment could lead to either a tightening or loosening of financial conditions (see Das and others 2023). Here the focus is on the pass-through of monetary policy to deposit rates.

[25] For further analysis, please see Das and others (2023).

[26] As shown in Duquerroy, Matray, and Saidi (2022), an increase in banks' cost of funding leads to a decline in credit and higher lending rates.

Figure 18. ME&CA Banking Systems: Monetary Policy Pass-Through across Scenarios



Source: IMF staff calculations.
Note: CBDC = central bank digital currency; ME&CA = Middle East and Central Asia.

Our model estimates show that an unremunerated CBDC has no impact on monetary policy pass-through, defined here as pass-through from policy rates into banks' funding costs. Pass-through would remain at about 70 percent in Georgia, 75 percent in Qatar, and 72 percent in Tunisia (Figure 18). Unremunerated CBDCs do not materially affect banks' funding mix. Under the assumption that a CBDC is non-interest-bearing and cash-like, it does not compete with deposits. Even when assumed to be checking account–like, the difference in remuneration rates between CBDCs and bank deposits implies a low take-up of CBDCs and thus no measurable effect on interest rate pass-through into banks' cost of funding. These findings are consistent with recent work by Das and others (2023).

With only a few countries around the world having adopted CBDCs so far, the potential impact on broader monetary policy remains uncertain. There is a range of estimates for the impact of CBDCs on monetary policy transmission for advanced economies,[27] which often depend on assumptions and on the transmission channels modeled.[28] CBDCs may also reduce the incentives to hold alternative means of payments (such as foreign currency); this could affect the exchange rate channel of monetary policy.[29] Understanding a CBDC's overall impact on monetary policy would require a more comprehensive general equilibrium analysis that allows for the introduction of the many different transmission channels. Such analysis would also be needed to understand the potential impact on inflation, which is an important policy question (see also Das and others 2023).

[27] Relevant papers include Davoodalhosseini (2022), Keister and Sanches (2023), and Keister and Monnet (2022).

[28] CBDCs could also affect monetary transmission by relaxing the zero lower bound or allowing for more targeted monetary policy, including non-uniform household transfers (Davoodalhosseini, Rivadeneyra, and Zhu 2020).

[29] Davoodalhosseini, Rivadeneyra, and Zhu (2020) develop this argument in the context of advanced economies. A priori, it is, however, unclear whether CBDCs would affect dollarization. It is unlikely that CBDCs would reduce dollarization if it is the result of a lack of trust in domestic institutions.

The impact of CBDCs on monetary policy transmission in ME&CA countries is uncertain and requires more research. Preexisting impediments to monetary transmission in ME&CA—structural excess liquidity, high dollarization, strong presence of state-owned banks, lending rate caps, and subsidized lending schemes—could continue to dampen monetary policy transmission and offset any benefits of CBDCs (Annex 5). Strengthening monetary frameworks along various dimensions will remain a priority for the region.

5. CBDC Design

Our survey highlights the significant challenge posed by the uncertainty surrounding appropriate CBDC design features. Achieving policy objectives, addressing inefficiencies, and mitigating risks rely on the design features chosen. Key concerns include accessibility, efficiency, security, resilience, financial integrity, and the privacy of a country's payment systems. Several design features are necessary to address these concerns and ensure that CBDC implementation aligns with the "do no harm" principle to monetary and financial stability. Having financial safeguards and integrity should always be an overarching priority.

A. Operating Model

The choice of CBDC operating model can help address some of the possible barriers to financial inclusion and access to payments. Therefore, choosing an appropriate operating model is a key consideration, specifically the role of the central bank and the private sector in issuing the digital currency and interacting with end users (Table 2). Options include (1) a direct or unilateral model, where the central bank performs all payment functions, from issuing to distributing and interacting with end users; (2) an intermediated model, an indirect approach where the central bank issues the CBDC and end users have direct claims on the central bank, but the private sector is responsible for interacting with the end users (Soderberg and others 2022); and (3) a synthetic model, an indirect approach where the CBDC system allows intermediaries to issue digital money backed one-to-one by central bank-issued currency.

Table 2. Operating Models of CBDC

Direct/Unilateral CBDC	Intermediated CBDC	Synthetic CBDC
Central bank issues and manages digital currency, including all interactions with end users.	Central bank issues digital currency but authorizes private sector financial intermediaries to interact with end users.	Private sector payment providers issue digital money backed by central bank assets.

Source: IMF staff calculations.
Note: CBDC = central bank digital currency.

The three possible operating models for CBDCs have different implications for adoption rates. In principle, a direct model allows a central bank to provide payment functions to everyone, including those in unbanked areas—a particular concern given the many FCSs in the ME&CA region. However, building and operating the technical capacity might be costly for a central bank. The private sector may be better positioned to undertake end user interactions given their technical know-how and existing networks but need stronger incentives to broaden their payment services.

ME&CA countries prefer an intermediated model where the private sector interacts with end users. This preference may reflect central banks' desire to balance ownership and capacity by maintaining core functions (issuing CBDC) while outsourcing a subset of functions to the better-equipped private sector to minimize legal and operational challenges (Soderberg and others 2022). In the case of the DT, the National Bank of Kazakhstan (NBK) views itself as a "platform operator" by maintaining the core rulebook (core principles of transactions/use, the legal basis, governance, risk management, and access) and core infrastructure (the ledger and monitoring/safeguard functions). In contrast, PSPs are responsible for processing payments,

including authorization, verification, validation, screening (for example, security and regulatory checks), and data and analytical services (NBK 2021). Georgia's digital lari pilot project will follow the existing two-tier financial system where authorized and regulated financial institutions are responsible for servicing retail clients. However, the National Bank of Georgia is still evaluating whether it or PSPs will record transactions. In addition, a set of technology-related operations will also be delegated to the selected technology partners to act as a bridge between the central bank, PSPs, and other third-party product and service providers (National Bank of Georgia 2023).

B. Technological Choices

The choice of CBDC technologies could have far-reaching implications for the efficiency, security, and resilience of the payment system centered around the digital currency. By choosing the right technology, a CBDC could foster competition and improve payment efficiency while minimizing stability risks. However, technological options are still in their infancy, with limited innovators that the ME&CA region can look to for comparison and guidance. LICs and FCSs underscore that their central banks lack the capacity, structure, and resources to tackle various design and technological challenges, including legal and regulatory obstacles, cybersecurity, and financial integrity concerns.

Countries in the pilot or advanced research stage appear to prefer a permissioned distributed ledger technology (DLT)-based CBDC, where the central bank retains key controls. The Islamic Republic of Iran, where the "crypto trial" has finished the pre-pilot phase, will run on a platform called Borna, a permissioned DLT platform, meaning the central bank decides which entities have access. The technology was developed using Hyperledger Fabric, the open-source enterprise blockchain platform established by IBM.[30] Kazakhstan is basing its DT on DLT while preserving some aspects of a centralized system, such as network access control for new participants. However, the NBK is still considering whether to develop its in-house permissioned DLT platform or rely on vendor-developed solutions or open-source software (NBK 2021). For Georgia, a private permissioned DLT network is currently considered the preferred technology, but configuration preferences might change as the central bank continues to evaluate the best-suited design (National Bank of Georgia 2023).

Some countries in less advanced research stages are also preparing their technology infrastructure. For example, the State Bank of Pakistan's recent progress in developing its CBDC underscores the need for robust technological infrastructure to support digital currency implementation (Digital Pakistan 2023). The National Bank of Egypt joined enterprise software firm R3's global blockchain initiative to bridge their design's technological challenges. Other countries (for example, the United Arab Emirates) have taken a different approach, outsourcing the technological aspects to digital finance services providers.

ME&CA country experience in CBDC design highlights the importance of offline capacity for expanding financial inclusion and access to payments. This feature is essential for facilitating digital payments as digital readiness is relatively low in the region, particularly in MENA oil importers, and for improving resilience during natural disasters and in conflict-affected economies. Kazakhstan has tested offline transactions employing tokens (purchase and transfer) using digital wallets and is exploring solutions for device misplacements. Georgia is also exploring both digital and offline solutions.

ME&CA countries can become leaders and pioneers in CBDC technology. In early 2023, the United Arab Emirates unveiled a new CBDC strategy for the digital dirham, with completion expected over the next 12 to 15 months (Central Bank of United Arab Emirates 2023). The project's first stage entails setting up digital payment infrastructure and services, including issuing a CBDC for cross-border and domestic use, which,

[30] The Islamic Republic of Iran has reportedly completed the pre-pilot phase of its "crypto rial," but details of the project remain limited (Motamedi 2022).

if successful, could provide comparator countries in the region with a technological skeleton to adapt and follow. Kazakhstan is positioned to pave the way in the CCA, having confirmed the DT as a feasible project and finalizing prototype testing of the new digital platform by the end of 2022 (NBK n.d.).

C. Safeguard Options for Financial Stability and Integrity

Financial safeguards may be imposed to ensure no harm to monetary sovereignty and transmission and financial stability and integrity. CBDC design should prioritize resilience to cyberattacks, fraud, and operational failure. Such disruptions could lead to massive financial losses that are difficult to recover, have profound reputational costs for central banks, and undermine monetary sovereignty. Design features should also balance protecting consumer privacy with discouraging illicit use. This balance is particularly important in ME&CA countries where regulatory and technological capacity may be weak.

Authorities should carefully consider restrictions or requirements on remuneration, levels of anonymity, and balance and transaction limits to safeguard against risks to financial stability and integrity. Introducing a positive or negative remuneration on CBDC holdings could have more financial stability implications than when a CBDC is unremunerated. Authorities could use carefully calibrated restrictions on CBDC balances or transactions to limit the extent of disintermediation of the banking sector. Too tight limits could discourage adoption, while too loose could be ineffective in safeguarding the financial system. A fully anonymous CBDC would not be compatible with financial integrity. Still, restrictions on anonymity may go against the objective of greater financial inclusion (non-anonymous payment services often require some forms of identification, the cost of which can be exclusionary). A potential solution is to provide a tiered selection of wallets with different limits for holding balances and transactions, allowing for greater anonymity for lower limits.

ME&CA countries actively pursuing retail CBDCs are opting for zero remuneration and low balance and transaction limits for now. This choice ensures the digital currency will be akin to physical currency and may limit the extent to which CBDC competes with bank deposits, alleviating risks to monetary transmission and financial stability. Central banks in both Georgia and Kazakhstan are also considering quantitative restrictions on holdings or transactions of CBDC to limit excessive capital flows to and from the banking sector and risks of illicit uses (NBK 2021; National Bank of Georgia 2023).

A programmable CBDC could strengthen payment efficiency and monetary sovereignty and transmission but could also pose risks to the financial system. Digital currency programmability generally refers to the ability to automate or direct transactions contingent on prespecified conditions. Georgia and Kazakhstan are actively exploring smart contract features for social assistance transfers. Still, opinions vary on programmable CBDCs, with some central banks against them due to limitations on the fungibility of money and lower user trust, which could lower adoption.

D. Cross-Border Considerations

Convenient CBDC cross-border functions could improve the efficiency of cross-border payments, particularly remittances, where systems in many ME&CA countries rely on informal channels with long settlement times and limited access to cross-border settlements. Such a scenario points to wholesale CBDCs, which are typically limited to financial institutions and designated payment providers, involving fewer resources and risks when compared to retail CBDCs. A wholesale CBDC, despite its limited scale and resource commitment compared to a full-fledged retail CBDC, could also facilitate cross-border payments by improving operational efficiency (for example, cash management costs) of exchange houses and banks. One challenge is that cross-border transactions involving different CBDCs would require a common standard for interoperability,

which needs to be developed and agreed upon by multiple central banks.[31] The IMF is working on a concept for a global CBDC platform where central banks agree on a common regulatory framework for digital currencies to facilitate global interoperability (Adrian and Mancini-Griffoli 2023).[32]

Two wholesale CBDC projects are being developed actively with central banks in other regions. Project Aber (Saudi Arabia, United Arab Emirates), launched in 2019, is testing DLT-based cross-border payment solutions that can overcome inefficiencies in existing cross-border interbank payments. Additionally, the central banks of China, Hong Kong SAR, Thailand, and the United Arab Emirates are working together to build a multi-CBDC platform known as mBridge. This platform is based on DLT (the mBridge Ledger) to support real-time cross-border payments and foreign exchange transactions using a wholesale CBDC. The Central Bank of Bahrain is also testing a wholesale CBDC based on the JPM Coin system, but mainly for interbank transactions instead of cross-border payments.

E. Legal Underpinnings

Issuing CBDCs is a new central bank function that requires a sound legal underpinning. The need for legal reform will vary depending on the design and use cases for the CBDC. Countries will need a clear mandate on central bank law to allow for the issuance of currency in the digital form; if the CBDC is account-based, one could see it as the central bank expanding the eligible bank account holders from financial intermediaries and the government to the wider public. Regarding monetary law, amendments to some existing provisions may need review to accommodate CBDCs. For example, legal amendments would need to add digital currency to the country's definition of legal tender. The authorities should also examine specific legal issues relating to criminal law protection of CBDCs, the treatment of CBDCs under private laws, and the impact of CBDC issuance on the central bank's internal governance (see Bossu and others 2020).

Most countries in the region are aware that their legal frameworks may need updating before CBDC implementation. For example, in principle, the Central Bank of Egypt has the legal function to issue currency in digital form. However, the monopoly of issuance provision in monetary law would need revision, and, depending on the design of the CBDC, the central bank's power to give access to central bank accounts and facilities may need review (IMF 2022c). In Jordan, the central bank does not have the legal mandate to issue currency in digital form nor to issue an account-based retail CBDC, nor is it clear whether a retail CBDC would have legal tender status (IMF 2022d). For Azerbaijan and the Kyrgyz Republic, laws will need to change before the central bank can issue a CBDC—neither country's laws give the central bank the legal foundation to issue currency in digital form. If the authorities decide to issue an account-based CBDC, the law will need to empower the central bank to open accounts for the CBDC-holding public (IMF 2022b for Azerbaijan).

F. Mitigating Operational and Reputational Risk

Central banks will need to identify the operational and reputational risks of CBDCs and take appropriate design choices. Central banks must uphold public trust in the means of payment. As such, they must ensure that the new digital asset is safe, secure, and efficient. As the guarantor of the currency, any operational failure—even if caused by intermediaries or third-party providers—will impact central bank credibility.

[31] Cross-border use of CBDCs also entails risks including those to financial stability, monetary sovereignty, and financial integrity, and may require appropriate regulations (IMF 2020; He and others 2023).

[32] To facilitate interoperability, in October 2020, the Group of Twenty endorsed a roadmap to enhance cross-border payments (BIS 2020).

Operational risks can range from minor to major service failures relating to:

- *Privacy of personal data*. Using physical cash is anonymous; it does not require the user to disclose personal information. In contrast, CBDCs could require basic information on user identity and transactions. This data must be stored safely.
- *Cyberattacks*. CBDCs could be the target of cyberattacks, which could test payment system resilience.
- *Integrity*. CBDCs must comply with anti–money laundering (AML)/combating the financing of terrorism (CFT) regulations to avoid financial misuse of the currency for illicit purposes.
- *Outsourcing of third-party providers*. Outsourcing to third parties, while cost-effective, could be a source of operational risks if proper safeguards and monitoring are not in place.

Reputation risks can arise from a broader set of implementation issues relating to:

- *Implementation cost*. The costs associated with CBDC implementation could be substantial; with so few CBDCs in operation, there is no established benchmark for the cost of CBDC issuance. Implementation costs would be for research, developing the infrastructure and technology, maintaining and upgrading the system, and the staff performing these operations and supervising the system. Central banks must carefully assess whether the benefits of CBDC adoption outweigh the costs to avoid reputational risks.
- *Low CBDC uptake*. If uptake of the CBDC is lower than expected, policymakers will require justification from the central bank for why adopting a CBDC was deemed necessary, especially if the cost was high and benefit marginal. This scenario could materialize in the case of a disintermediated distribution model for a CBDC in which the intermediaries lack the incentives to expand the user base.
- *Energy sustainability*. If the amount of energy resources necessary for the system to operate is high or underestimated, this could also generate reputational risks.
- *Lack of legal and regulatory framework*. Once policymakers determine that the benefits of CBDC outweigh its costs, it is important to put in place a clear legal and regulatory framework for the system to operate effectively.

6. Conclusion

CBDCs are a promising option for central banks in a rapidly digitalizing world, but costs and benefits are country-specific and will require a comprehensive analysis. This paper aims to support ME&CA policymakers considering the adoption of a CBDC by examining the following key questions: What objectives do policymakers aim to achieve with a CBDC? Which inefficiencies in payment systems can CBDCs address? What are the implications of CBDC issuance for financial stability, monetary policy pass-through, and central bank operational risk? How can CBDC design help achieve policy objectives and mitigate these risks?

The answers to these questions will depend on a country's economic and financial conditions. Hence, while the paper does not recommend whether a country should adopt a CBDC, it does provide preliminary answers to the above questions in a regional context by highlighting the main features of ME&CA's payment, financial, and monetary systems. However, further research is needed to consider the broader implications of CBDCs on monetary policy, inflation, and distributional impacts, among others. This paper aims to deepen the dialogue between the IMF and ME&CA policymakers on the implications of CBDC adoption on the region. The IMF will continue to assist country authorities in their journey to CBDCs by providing capacity development, analytical work, and a platform for peer learning.

The key findings of the paper can be summarized as follows:

- *CBDCs could promote financial inclusion if they address the current inefficiencies in the payment system.* If offered at a lower cost than existing alternatives, a CBDC could spur competition in the payment market and help increase access to bank accounts, improve financial inclusion, and update legacy technology platforms. However, CBDC uptake could suffer from the same barriers as other digital payments in the region due to low wealth, financial literacy, and other structural factors discussed earlier. In this case, gains in financial inclusion may not materialize.

- *CBDCs may also help improve the efficiency of cross-border payment services.* If designed to address frictions arising from a lack of payment system interoperability, complex processing of compliance checks, long transaction chains, and weak competition, the cost of cross-border transactions could go down significantly. There are already regional initiatives focusing on overcoming the complexities mentioned previously, providing opportunities for learning from peers.

- *CBDCs can raise financial stability implications, especially for banks with high reliance on deposits, which is a predominant feature of the ME&CA banking system.* CBDCs may compete with bank deposits, a primary funding source for ME&CA banks, reducing bank profitability and lending volumes. However, banking systems in the region generally have adequate capital, profitability, and liquidity buffers, which could help mitigate potential adverse impacts from CBDC competition. Still, it is important to monitor the entire distribution of banks. While there are no clear prerequisites to adopting CBDCs, a healthy banking system, a sound legal basis, and strong supervisory and regulatory capacity are paramount to tackling any possible adverse implications.

- *CBDCs could have a potential impact on monetary policy pass-through.* CBDCs could strengthen monetary policy pass-through into deposit rates by increasing competition and reducing the banking system's market power. CBDCs could also strengthen the bank lending channel of monetary policy. However, the impact, which would be country-specific, is difficult to estimate due to limited CBDC uptake.

Annex 1. Middle East and Central Asia Department Survey

The Middle East and Central Asia Department conducted a survey of 31 IMF country teams working on ME&CA economies. The IMF country teams that participated in the survey were Algeria, Armenia, Azerbaijan, Bahrain, Djibouti, Egypt, Georgia, the Islamic Republic of Iran, Iraq, Jordan, Kazakhstan, Kuwait, the Kyrgyz Republic, Lebanon, Libya, Mauritania, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tajikistan, Tunisia, Turkmenistan, United Arab Emirates, Uzbekistan, West Bank and Gaza, and Yemen.

The survey employed a multiple choice questionnaire format to collect data from the participating IMF country teams, resulting in a response rate of 100 percent for the ME&CA region. Data collection took place in March 2023, ensuring the most current information from the IMF country teams at that time. However, it is important to acknowledge that the survey was conducted with IMF country teams rather than engaging directly with central banks. While efforts were made to ensure the reliability and representativeness of the findings, this approach may slightly impact the generalizability of the results. Survey data was additionally validated with publicly available speeches and available information from central banks. The survey included the following questions:

1. Please indicate which country you are working on.
2. Have your country's authorities expressed interest in the introduction of a CBDC?
   a. Yes, actively pursuing
   b. Yes, thinking about it
   c. No
   d. Not sure
3. What CBDC are the country authorities interested in?
   a. General purpose (retail) CBDC
   b. Wholesale CBDC
   c. Both
   d. Not sure
4. What are the main objectives your country authorities would like to address with CBDC? Please select all that apply and rank by priority.
   a. Increasing financial inclusion
   b. Broadening access to payments
   c. Making payments more efficient (domestic)
   d. Making payments more efficient (cross-border)
   e. Ensuring resilience of payments
   f. Reducing illicit use of money
   g. Upholding monetary sovereignty
   h. Enhancing monetary policy implementation
   i. Increasing competition in the payments sector
   j. Not sure

5. What are the main challenges/hindrances that need to be addressed before proceeding with a CBDC? Please select all that apply.
   a. Deciding on the appropriate design features
   b. Deciding on the desired technology approach
   c. The legal framework needs to be changed/updated
   d. The central bank does not have the existing structure to support the implementation of CBDC (for example, staff, technology)
   e. The regulatory framework needs to be changed/updated
   f. Financial integrity concerns
   g. Cybersecurity concerns
6. Are country authorities considering restrictions to ensure financial stability? Please select all that apply.
   a. Restrictions on renumeration of CBDC
   b. Quantitative restrictions on holdings or transactions of CBDC
   c. Tiered fees
   d. Anonymity
   e. Restricting foreign ownership
   f. Other
   g. Not sure
7. What would be the operating model, namely, the role of central bank versus private sector?
   a. Unilateral CBDC (central bank carries out all functions in the payment system)
   b. Intermediated CBDC (central bank issues CBDC but private sector interacts with end user)
   c. Synthetic CBDC (digital currency issued by private firms not central bank)
   d. Not sure
8. In your view, is there a compelling case for the authorities to adopt CBDC? Would a CBDC address the main pain points?
9. Do you see possible challenges in CBDC uptake (low uptake/acceptance)? If so, what will be the likely reasons (for example, high cash dependency)? What could help improve the take-up and acceptance?
10. Are digital payment methods widely available and being used? If so, which ones?
11. Has your country requested or undertaken any IMF technical assistance on digital money? If so, please share the details so we can follow up with the Money and Capital Markets Department.

Annex 2. Defining CBDCs

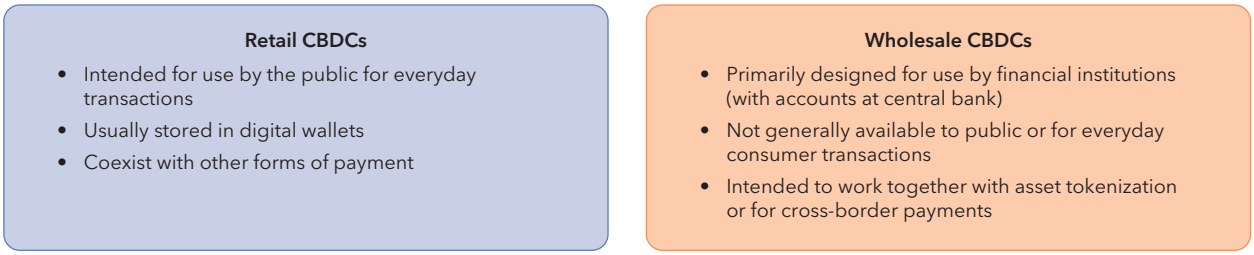
This annex defines CBDCs, differentiates between retail and wholesale options, and touches upon some key technical and legal attributes of digital currencies. The aim is to provide a clear understanding of CBDCs and avoid potential confusion with other forms of digital payment.

A CBDC is a digital form of money issued and regulated by a central bank.[33] It is intended to serve as legal tender and can be used as a means of payment and a store of value. A CBDC would be denominated in the same unit of account as the local currency. In most countries, the goal of a CBDC is to expand the means of payment options and improve the convenience over currently used cash. However, it would differ from other forms of money typically issued by a central bank, namely cash and reserve balances. One main difference between cash and a CBDC is that cash is anonymous, while a CBDC is not. A CBDC would differ from reserves balances (already digital) since it would be accessible to the population at large. Central banks would also issue it as their liability, thus forming part of the monetary base (or M0). In addition, compared to existing central bank liabilities, a CBDC would offer increased technological opportunities, for example, through programmability of payments and, more generally, by creating a technological platform over which the private sector can offer financial services (for example, wealth advisory using payments data).

CBDCs can be introduced in two forms: retail CBDCs and wholesale CBDCs (Annex Figure 2.1).[34]

- Retail CBDCs are intended for use by the public for everyday transactions, such as payments for goods and services, person-to-person transfers, and bill payments. Retail CBDCs are stored in digital wallets, which can be accessed through mobile apps, cards, or other electronic devices.
- Wholesale CBDCs are intended for use primarily by financial institutions for large-value and high-volume transactions. Wholesale CBDCs can be used for interbank payments, clearing and settlement, and cross-border transfers.

Annex Figure 2.1. Retail and Wholesale CBDCs



Source: IMF staff.
Note: CBDC = central bank digital currency.

For households, CBDCs are an asset that can be used for various payments and as a store of value. Since CBDCs are digital, they could be used for online purchases and be beneficial for small businesses, which incur substantial costs for handling cash or substantial transaction fees for taking payments via debit and credit cards. In addition, unlike bank deposits and other digital payment options, CBDCs are issued by the central bank, meaning that they are not subject to credit or liquidity risk. However, like cash, households could also use CBDCs as a store of value.

[33] See also Soderberg and others (2023) for a more detailed description.

[34] Some countries in the region are also exploring wholesale CBDCs, but the benefits of issuing wholesale CBDCs could be limited due to underdeveloped financial markets in the ME&CA region.

CBDCs can be unremunerated or remunerated. Most countries in advanced stages of experimentation are considering unremunerated CBDCs—a central bank liability with a zero interest rate, like cash. Some countries are also asking whether benefits could arise from remunerated CBDCs. For example, the remuneration rate could become another policy tool central banks could use to improve monetary policy transmission. In addition, a remunerated CBDC could be used for investment purposes. However, remunerated CBDCs also pose greater risks to financial stability since they become a closer substitute to bank deposits. As for the time being, ME&CA countries are not considering remunerated CBDCs; this paper focuses on unremunerated CBDCs (see Annex 5 for an analysis of the potential implications of remunerated CBDCs).

CBDCs have specific technical attributes. Households can access, store, and make payments with a CBDC through a digital user interface. They typically do this by using applications on a mobile phone or a preloaded card that works offline. However, to be used for payments, countries need financial market infrastructure to settle CBDC exchanges between consumers and merchants or peer-to-peer transactions (see Soderberg and others 2023). Therefore, central banks should consider the need to build in-house capacity and the costs associated with introducing a new means of payment, including the necessary infrastructure. Together with a feasibility study on the possible benefits and costs of CBDC adoption, extensive testing of technology, systemic stability of the financial system, and the resilience of CBDCs in the event of possible system failures and cyberattacks need to be part of central bank agendas when considering CBDCs.

CBDCs must have a legal framework that allows issuance by the central bank and defines the roles and responsibilities of all participants in the financial ecosystem. CBDC issuance and distribution require a sound legal basis and robust regulatory foundation. Therefore, before launching a CBDC, policymakers should review the existing legal framework to identify needed legal and regulatory changes. In addition, the introduction of a CBDC may exacerbate existing vulnerabilities, including those related to AML/CFT measures. As such, CBDCs must adhere to all AML/CFT provisions and the country's laws for data protection and privacy.

Annex 3. Main Objectives for Adopting CBDCs

A commonly stated objective for pursuing a CBDC is to enhance *financial inclusion* by providing low-cost, secure, and accessible financial services to marginalized and low-income populations (Omar and Inaba 2020; Demirgüç-Kunt and others 2022; Park and Mercado 2021). CBDCs can reduce the costs associated with traditional banking systems, making financial services more affordable for those living in poverty. However, the development and implementation of CBDCs must be deliberate in seeking inclusiveness and accessibility, which requires collaboration between central banks, governments, and the private sector from the initial design. It is important to take stock of the barriers to financial inclusion in each country before embarking on a CBDC. Some common barriers are low wealth, high fees for financial products and services, lack of financial history, no mobile and internet access, insufficient documentation, distrust in financial services, poor financial literacy, high labor informality, and preference for cash. Understanding these barriers would provide insight into whether a CBDC or other digital option can address them. The literature suggests that policymakers face a trade-off between financial inclusion and intermediation. A CBDC designed with lower usage costs and interest rates makes the inclusion-intermediation trade-off more favorable as these designs allow for adoption by financially excluded individuals (Banet and Lebeau 2022).

Access to payments is a crucial objective for central banks, as it underpins economic activity and fosters financial stability. Although financial inclusion and access to payments are closely linked, it is important to note that they are distinct concepts. Even in countries with high levels of financial inclusion, limitations to access payments may arise due to factors such as cash shortages, businesses declining cash payments, or inadequate digital infrastructure. For example, one of the main objectives of the Bahamian Sand Dollar is to increase access to payments, enabling individuals and businesses to make digital transactions, receive payments, and access financial services more easily, fostering greater participation in the formal financial system.

By improving the *efficiency of payment systems*, CBDCs can offer digital forms of payment that are cheaper and more efficient to operate. Operational costs are high in countries with high use of cash and checks. Similarly, in some countries, existing digital payments are also relatively expensive. Central banks operate on a nonprofit basis, so they could offer a public good at a potentially low payment cost and subject to the need. For example, The Bahamas and the Eastern Caribbean Currency Union are high-cost jurisdictions for both physical and existing digital payments. There are plans for the Sand Dollar to be integrated with government agencies to support digital government payments to individuals and thus lower this cost.

CBDCs have the potential to improve the *resilience of payments*. As a corollary of network effects, few payment system providers may operate in one country (for instance, duopoly Mastercard/Visa). This diversification reduces the dependency on a limited number of payment providers and minimizes the risk of payment interruptions due to technical glitches or outages. By fostering competition and expanding payment options, the overall payment ecosystem is strengthened, ensuring that individuals and businesses have reliable alternatives even during unexpected disruptions.

CBDCs can help combat the *illicit use of money* by improving the traceability and transparency of transactions. This was another primary reason for The Bahamas to issue a CBDC. CBDC systems can be designed with AML/CFT measures integrated directly into their design. For example, a CBDC system could include transaction monitoring, identity verification, and the ability to freeze or seize accounts suspected of involvement in criminal activity (CPSS-IOSCO 2019).

The emergence of private crypto assets and foreign CBDCs has raised concerns about *monetary sovereignty*, as these instruments have the potential to challenge the role of central banks in the economy. As argued in the literature, the proliferation of nonsovereign money can undermine the ability of central banks to conduct monetary policy and stabilize the economy (Gabor 2020). CBDCs can, however, serve as a safeguard for monetary sovereignty by providing a safe and reliable alternative to private crypto assets and foreign CBDCs (Sethaput and Innet 2023). CBDCs can preserve monetary sovereignty by facilitating cross-border transactions, reducing the need for intermediaries and promoting financial integration (Andolfatto and Nosal 2020).

CBDCs would preserve the role of public money as the *monetary anchor* of the payment system. For most countries, central bank money is available to the public only in the form of bank notes. Cash underpins the stability of the payment and financial system as it provides the ultimate settlement asset. In a world where consumers prefer digital payments and cash is disappearing, CBDCs could provide the equivalent economic function of cash in a digital format. Thus, in a digital world, CBDCs would preserve the role of central bank money as a stabilizing force of the payments system.

Annex 4. Middle East and Central Asia Department Case Studies

A. Jordan

At the request of the Central Bank of Jordan (CBJ), the IMF provided technical assistance to the CBJ starting in late 2021.[35] The main objective of the technical assistance was to assist the CBJ in thinking through key elements of the CBDC exploration process and to lay the foundation for a feasibility study. The technical assistance covered conceptual and operational issues related to CBDC, including opportunities, challenges, design options, technology and cybersecurity risks, legal and regulatory frameworks, and macrofinancial implications.

The authorities' initially stated objectives for exploring CBDC include (1) promoting financial inclusion, (2) improving both domestic and cross-border payment system efficiency (that is, real-time settlement availability; speed and reducing cost of transaction), (3) improving competitiveness in the banking system, and (4) reducing illicit activity (that is, tax evasion).

The existing retail payment systems in Jordan are highly integrated and offer generally available and appropriate products. Jordan has achieved a high level of interoperability between banks and PSPs through the Instant Payment Systems such as JoMoPay and CliQ. For cross-border payments, two initiatives in the region intend to implement real-time payments. One of them was launched in 2020, called Buna and led by the Arab Monetary Fund. Buna functions as a central routing agent to provide a common set of operating rules. Jordan is already a part of Buna which currently covers four Arab currencies (Egyptian pound, Emrati dirham, Jordanian dinar, Saudi riyal) and two international currencies (euro, US dollar). Buna and Jordan Payments & Clearing Company signed a memorandum of understanding to achieve interoperability between Buna and CliQ, therefore accelerating digitization of cross-border payments. Another initiative is the GCC RTGS. While Jordan is not part of this initiative, the GCC RTGS, often referred to as the "AFAQ" payment system, is expected to connect domestic RTGSs of respective central banks with the aim of creating standardized cross-border payments and further enhancing cost-efficiency and speed.

Multiple challenges explain the low uptake of digital payments, banking, and other formal financial services. Despite generally accessible and appropriate product offerings and an enabling environment with high smartphone penetration and a young population, barriers prevent customers from extensively using digital payments. These barriers include limited financial literacy, transaction fees, cash-oriented business models, and the persistence of "cash culture."

Retail CBDCs may not address some of the aforementioned barriers for the low uptake and adoption of digital payments, but it would offer three benefits. First, it could take advantage of network effects by removing fees and further enhancing interoperability between banks and PSPs. Second, it could contribute to enhancing the trust of customers who may still have reservations about financial services provided by the private sector. Third, it could reduce cross-border payment costs by, for example, reducing the cash management costs of exchange houses especially if retail CBDCs were used reciprocally with counterparts in remittance corridors.

[35] A high-level summary of the report on retail CBDC exploration has been published (Tsuda and others 2023).

There are certain risks to consider when issuing retail CBDCs; careful design choices can mitigate these. Some of the key risks to watch for include the following: (1) improper design could lead to financial disintermediation; (2) in stress periods, it could aggravate liquidity risk and lead to systemic risk; (3) a cross-border retail CBDC could increase exchange rate volatility due to larger and more volatile capital flows and present a heightened risk for use in illicit activity; and (4) a retail CBDC could be an attractive target for cyberattacks, amplifying cybersecurity risk.

The CBJ is evaluating the benefits and risks of issuing a retail CBDC. The CBJ is working on a feasibility study to further explore CBDCs. The authorities are also analyzing legal and cybersecurity issues and technology options. Their next step is to prepare a proof of concept for wholesale CBDCs. The IMF stands ready to provide further technical assistance to the CBJ in exploring CBDCs.

B. Kazakhstan

Since 2021, the NBK has been exploring the feasibility of issuing the DT. Following a decision-making framework for its implementation, it is currently conducting a second limited technical project to evaluate the feasibility of alternative payment scenarios and design choices. The DT would be another liability of the NBK coexisting with existing cash and non-cash money.

The DT is expected to complement existing national and private means of payment. The Interbank System of Money Transfer is an RTGS system for large payments managed by the NBK and supported by five systemically important payment system providers. The Interbank Clearing System is a net settlement system for small payments also managed by the NBK with payments executed sequentially on a first come, first served basis. There are also around 30 private sector money systems mostly managed by second-tier banks where electronic money is instead the liability of the private sector provider. The DT would complement all these systems with additional functionality in terms of accessibility, anonymity, bearer instrument, independence, operational efficiency, and programmability.

Other stated objectives of the DT include to promote competition among second-tier banks promoting financial innovation and the development of a wider set of payment services through remote biometric identification, programmability, and smart contracts, and to promote financial inclusion and penetration of non-cash payments due to the possibility (like cash) of offline payments.

The DT is still in its testing phase, and the NBK expects its full launch by the end of 2025. The 2021 project defined the key characteristics of the DT as a retail currency, token based, operating on a DLT, and distributed following a two-tiered, hybrid operational model. Under such a model, the NBK issues tokens to second-tier banks, monitors the security of the system, ensures the connection of participants to the payment system, is responsible for the distributed ledger, keeps a record of transactions and the balance sheets of both second-tier banks and their clients, discharges notary node responsibilities, and can halt, transfer balances, and restart the payment system in the event of an intermediary failure. Second-tier banks provide retail payment services to their clients by issuing distributing the DT through digital account wallets and discharge AML/CFT and Know Your Customer responsibilities. The ongoing 2023 technical project plans to evaluate more scenarios including the integration with international payment systems. It is expected to gradually expand in terms of functionality until full-scale launch of the DT by the end of 2025.

Uncertainties remain in relation to several design choices and necessary preconditions for the launch of the DT. For instance, the feasibility of safe and unlimited offline transactions has not been proven, and the introduction of quantitative limits for offline transactions may be needed to limit the risk of fraud. Similarly, the feasibility of unlimited low-cost payments has not been proven, and periodic reissuance of tokens would

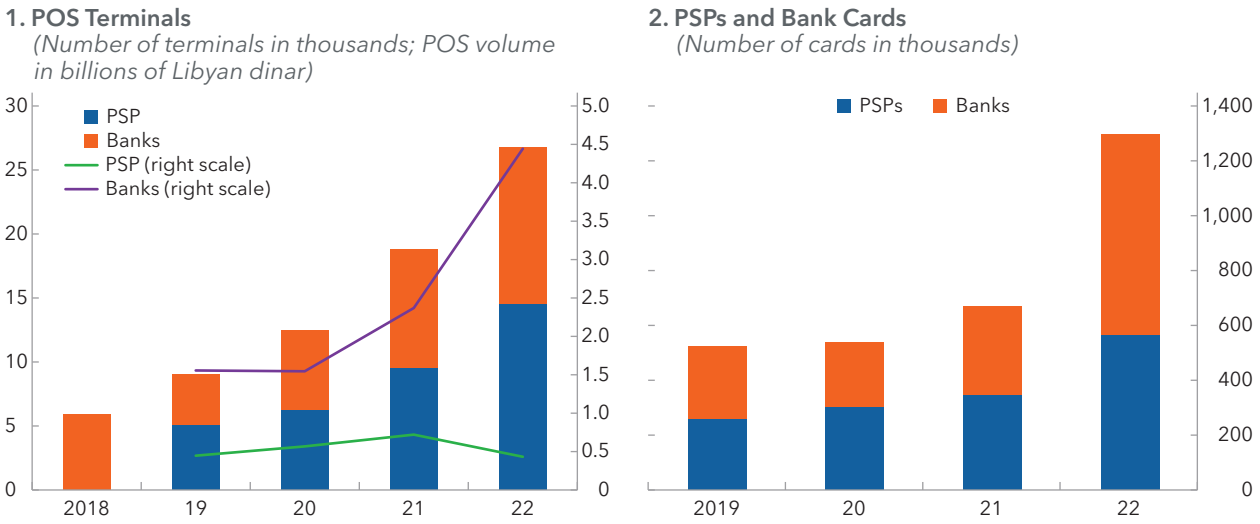
likely be required to keep costs low. The desired level of anonymity and confidentiality and the desired policies aimed at safeguarding consumer protection are yet to be defined. Finally, uncertainties remain in relation to the readiness of the regulatory framework.

The macroeconomic implications of the DT may become evident only over time. The introduction of a CBDC can have important macro and financial stability implications. The NBK assessed the macro implications of the DT through a series of studies suggesting that (1) the demand of the DT is limited and estimated at about 10–20 percent of available funds, (2) a nonremunerated DT would limit demand to about 5–6 percent of GDP, (3) the introduction of the DT would not increase the monetary base but only changes in the money supply structure, (4) the potential crowding out of bank deposits can be mitigated by introducing quantitative restrictions on the conversions of current accounts in DT wallets or other price measures, and (5) the interest channel of monetary policy transmission would be strengthened due to the complementarity of DT and cash. These conclusions appear linked to the limited scope of the 2023 technical project. The likely true macro impact of any design choice can only become evident over time.

C. Libya

The Central Bank of Libya (CBL) improved digital payment infrastructure, but institutional divisions threaten further progress (Annex Figure 4.1). The CBL operates four payment systems: the RTGS, the automated clearing house, the automated check clearing system, and the SWIFT portal. The national switch, owned by the top five banks, links the banks and the CBL to settle claims on point-of-sale terminals and cards. Despite substantial improvements in connecting banks to the payment systems, the digital payments landscape in Libya is fragmented with the eastern branch of the CBL operating parallel payment systems. The division creates liquidity pressure on the banks and decreases the efficiency of payment services.

Annex Figure 4.1. Libya Digital Payment Infrastructure



Sources: Central Bank of Libya; and IMF staff calculations.
Note: POS = point of sale; PSPs = payment service providers.

The conflict in Libya disrupted notes provision from the CBL to the banks and pushed customers to use electronic payments. Between 2018 and 2022, the number of point-of-sale terminals increased from 5,000 to 27,000, the volume cleared on automated check clearing system tripled to LYD65 billion, and the number of active cards increased from 0.5 to over 1.2 million. Nonbank PSPs licensed by the CBL played an important

role in the transformational journey to digital payments. However, the volume limits on cards and wallet transactions introduced by some banks to preserve liquidity, as well as the strong cash culture and the concentration of point-of-sale terminals in certain parts of the country, slowed down the adoption of electronic payments.[36]

The public has a preference to hold notes, and currency in circulation (CIC) is above 30 percent of broad money supply. High informality, weak rule of law, and banks' liquidity problems increased public preference for notes as a reliable means of payment. The fragile security situation and the distribution of the population over a large land mass increased the operational costs to supply notes and resulted in delivery delays that exacerbated the notes shortages.

The CBL is committed to the development of the digital payments' infrastructure. Future initiatives of the CBL include allowing international cards to be used in Libya, adopting chip and pin technology, using an automated clearing house for public sector salary payments, and expanding the national switch membership to encompass all banks. The CBL also intends to issue technical rules for payment services, introduce instant payments, and is exploring the potential role for a CBDC in the Libyan payment system.

A CBDC may help speed up the digitization of payment services, reduce CIC, and lower AML/CFT risks. The ability to use CBDCs offline, trace transactions, and make peer-to-peer transfers can help reduce the CIC, reduce AML/CFT risks, and improve the efficiency of the payment system. Furthermore, a CBDC can increase digital payments adoption, for example, if used to pay public sector wages and social benefits. It can also be programmed to deliver more targeted subsidies, and, if the CBDC adoption rate is high, can provide some protection against counterfeit currency.

Authorities should be mindful of the risks associated with CBDCs, such as banks' disintermediation and low public take-up. Credit to GDP in Libya is around 11 percent and most bank assets (approximately 60 percent) are liquidity held with the CBL. CBDC adoption is unlikely to lead to further disintermediation of banks, especially if the CBDC targets CIC and is not remunerated. Furthermore, experiences of other countries show a low adoption rate of unremunerated CBDC and raise legitimate cost-benefit concerns. Therefore, a detailed impact study should be conducted before proceeding with a CBDC project.

The high usage of mobile phones, a young population, and adequate foreign currency reserves supports CBDC adoption. As a liability of the CBL, the CBDC will be backed by high levels of foreign currency reserves of over 48 months of imports. This provides confidence and encourages the adoption of a CBDC. Furthermore, Libya has one of the highest numbers of connected mobile phones in MENA at around 120 percent of the population compared to a MENA average of 66 percent and an average of 68 percent globally (GSMA 2021). It also has a young population with a median age of 29 years. This implies that the population is potentially adoptable to new technologies, including CBDCs.

The CBL has expressed interest in CBDCs, and the IMF can assist the authorities assess its potential role in the payments system, if any. The payment system in Libya faces several challenges including the distribution of the population over a large geography, fragile security, AML/CFT risks, high CIC, and an inefficient banking system. A CBDC may be helpful in overcoming these obstacles, but it may also introduce new risks. However, the risks are likely lower in Libya compared to countries with more advanced financial systems. The IMF can assist the authorities assess the legal and technical requirements, financial stability implications, and the potential benefits of introducing a CBDC in Libya.

[36] Over 80 percent of the point-of-sale terminals are in the northwest part of the country. See World Bank (2020).

Annex 5. Model Overview and Estimates

To illustrate the implications of introducing a CBDC, we estimate the impact at the country level using the quantitative structural model of Gross and Letizia (2023).[37] We estimate the model for three countries with varying levels of financial development and distinct characteristics. Across countries, deposits are the primary source of funding for the banking sector, which makes these countries particularly suitable for the model. Moreover, all three countries have conducted initial research on the issuance of a CBDC. Qatar, a GCC country, is one of the most financially developed countries in ME&CA, with a high share of banking sector assets to GDP and low rates of cash usage. Tunisia, a North African emerging market economy, exhibits comparatively high reliance on cash and weaker monetary policy pass-through. Finally, Georgia is a CCA country with a substantial degree of dollarization and a highly concentrated banking system. Selecting three representative countries ensures that the estimation results are informative for other ME&CA countries with comparable characteristics.

Using simulated counterfactual scenarios for the countries of choice, the model aims to estimate the impact of CBDC on the following: (1) shares of CBDC in total money for different design features, (2) the extent of any deposit disintermediation and the associated increase in banks' reserve borrowing from the central bank, (3) deposit rates, (4) profitability of banks and the central bank, and (5) monetary policy pass-through.

A. Model Description

The model is structural yet closely connected to macrofinancial data by ensuring stock-flow consistency. It features three main actors: the central bank, commercial banks, and the aggregate nonbank sector (comprising households, nonfinancial firms, nonbank financial institutions, and the government). Their balance sheets are tightly connected, and the model ensures consistency between balance sheets and income flows between the different model actors. The central bank issues cash and reserves, whereas banks act as money creators.[38]

The key building block of the model is imperfect competition between banks as well as nonbanks' choice between deposits and cash. As banks have market power, deposits are priced at a markdown relative to the policy rate. Hence, banks have access to comparatively cheap deposit funding. Deposits and cash are held by the nonfinancial sector whose agents have preferences over the holdings of these two liabilities.[39] Finally, the central bank sets the policy rate, reserve requirements, and the reserve remuneration rate (which may differ between required and excess reserves). Banks are assumed to lend at the policy rate.

Using the calibrated model, several counterfactual scenarios are estimated. The first scenario is the current baseline in the absence of a CBDC, with parameters calibrated to recent macroeconomic aggregates. This provides a benchmark to which the counterfactual scenarios with a CBDC can be compared. The counterfactual scenarios fall into two groups, depending on the "base utility" of CBDC. In the first set of scenarios, the base utility of a CBDC is set to the base utility of cash, so a CBDC is perceived as "cash-like" by nonbank agents and competes with cash. In the second set of scenarios, the base utility of a CBDC is set to the base

[37] The model has also been used in independent work on Bahrain (IMF 2023c).

[38] The explicit modeling of banks as money creators distinguishes the model from many models in the literature where banks only act as intermediaries (for example, Agur, Ari, and Dell'Ariccia 2022; Fernández-Villaverde and others 2021; Keister and Monnet 2022; Keister and Sanches 2023).

[39] Technically, nonbanks' utility is modeled with a random utility model that has a nested logit structure, building on McFadden (1978).

utility of deposits, so the CBDC is "deposit-like" and competes with both deposits and cash. Across both sets of scenarios, the impact of different CBDC remuneration rates ranging from 0 to 100 percent of the policy rate is considered.

As with any structural model, the model must abstract from some economic characteristics. In particular, the model does not feature foreign currency deposits. The extent to which these would be affected by the introduction of a local currency CBDC remains an open question. In countries where the main motive for dollarization is low trust in domestic institutions, the introduction of a CBDC by a local central bank may not affect the motive for holding dollars. In future work, a richer menu of deposit contracts with different remuneration rates (for example, savings versus time deposits) could be considered. While the nonbank financial institution sectors in ME&CA are currently small in most countries, more work on the impact of CBDC on nonbank financial institution balance sheets might be of interest. Endogenous adjustment of loan rates is another element that could be incorporated in future work to conduct a more comprehensive analysis of monetary policy transmission as the current model only captures the pass-through into banks' cost of funding. Finally, the model does not consider network effects in the adoption and use of CBDC (Agur, Ari, and Dell'Ariccia 2022), as well as design options that could spur its adoption (for instance, those aimed at broadening financial inclusion).

B. Model Parameterization

The calibration process targets a country's deposit rate and cash ratio by selecting the optimal number of banks and base utility of cash (Annex Table 5.1). In the first step of the calibration procedure, the sensitivity of deposits to the deposit rate, β, is estimated. In the second step, we estimate the optimal number of banks and the base utility of cash that optimally match the prevailing deposit rates and cash ratios in each country (Annex Table 5.2).

C. Model Main Findings

A CBDC could attain a significant share of total money supply across all three country cases. In the highly cash-reliant economies of Georgia and Tunisia, an unremunerated cash-like CBDC would attain a share of close to 10 percent in total money. With a positive remuneration rate, or when CBDC is deposit-like, the share of CBDCs in total money could reach 30 and 25 percent in Georgia and Tunisia, respectively.[40] Deposit-like CBDCs could attain a share in total money of up to 30 percent depending on remuneration rates and would reduce both deposits and the cash share.

Banks would raise their deposit rates in response to the competition from a remunerated CBDC. A deposit-like CBDC reduces bank deposits, particularly when remuneration is at or close to the policy rate. For Georgia and Tunisia, deposits decline by about one-third. The maximum deposit outflows are smaller at around 26 percent for Qatar, because the spread policy rate–deposit rate is lower, so a CBDC induces less deposit outflows. Banks partially increase their deposit rates to mitigate the deposit outflow. Hence, the quantity of deposits falls while deposit rates increase.

To compensate for the decline in deposit funding, banks would increase their reserve borrowings from the central bank. Up to one-third of bank funding would come from reserve borrowings if a CBDC is deposit-like and fully remunerated. While banks could also resort to other funding sources such as wholesale funding, the role of wholesale funding markets remains small in many countries of the region, amid low levels of development of the nonbank financial institution sector and equity markets that are likewise small in many countries.

[40] For Qatar, the impact of cash-like CBDC is small because the baseline cash-to-M2 ratio stands at 2.18 percent.

Annex Table 5.1. Model Parameterization

Parameter	Symbol	Tunisia	Qatar	Georgia	Comments
Number of Banks	B	6	11	5	Part of the parameter set that determines the "intensity of competition" captured by the model and is not to be interpreted as the actual number of banks in the banking system.
Base Utility for Cash	α_{CASH}	2.6	2	2.1	Represents the utility that nonbank agents derive from holding cash and is relative to the base utility of deposits (α_{DEP}), which is normalized to zero and assumed to be equal for all banks in the model.
Price Sensitivity	β	55	140	25	Captures nonbank agents' willingness to alter their money holding composition in response to changes in interest rates on the different forms (and across banks). Together with the parameter B and α_{CASH}, it is used to let the model match the target deposit-policy rate spread and target cash ratio.
Velocity of Money	γ	0.3609	1.36	2	Informed by annual nominal GDP-to-M2 ratios from 2021:Q4.
Reserve Requirement	λ	1%	4.5%	5%	As per current central bank setting.
Reserve Borrowing Rate	i^{RB}	6.5%	3.41%	10.5%	Recent policy rate.
Reserve Remuneration Rates for Required and Excess Reserves	$[i^{RRH}, i^{ERH}]$	[0.29%, 1.75%]	[0%, 3.41%]	[10.5%, 10.5%]	Recent reserve remuneration ratio.

Source: IMF staff calculations.

Annex Table 5.2. Model Targets

Parameter	Tunisia	Qatar	Georgia	Comments
Deposit Rate	4.12%	2.51%	5.03%	Calculations based on Fitch Connect data.
Cash Ratio	18.69%	2.18%	22.45%	The cash ratio is defined as cash/M2.

Source: IMF staff calculations.

While net income declines, banking systems would remain profitable. The combined impact of higher deposit rates and increased reserve borrowing from the central bank—which is more expensive than deposit funding—is an increased cost of funding for banks, resulting in lower profitability.[41] In Tunisia, systemwide

[41] In the model, loan rates do not endogenously adjust to the introduction of a CBDC but are instead fixed ex ante, as is the size of bank balance sheets. In a richer model, banks may respond to the introduction of a CBDC not only with higher deposit rates but also by adjusting loan rates and adjusting the size of their balance sheets. Hence, the profitability results from this model should be interpreted with these caveats in mind.

return on assets (RoA) would decline by 0.4 percentage point, in Georgia by 0.5 percentage point, and in Qatar by 0.2 percentage point. These results indicate that introducing a CBDC into an already competitive banking system would have little impact on the equilibrium deposit rate and hence the RoA, which would be the case in Qatar. In contrast, introducing an additional competitor in a less competitive system would have a bigger impact on the margin, which would be the case in Georgia and Tunisia. Moreover, the substitution from comparatively cheap deposit funding to other sources of funding leads to a greater increase in funding costs, and hence decline in RoA, in those countries with larger initial policy rate–deposit rate spreads.

As a result, aggregate bank-level capitalization would remain unaffected by the introduction of a CBDC. Still, it is important to monitor the entire distribution of banks. Since the overall banking system remains profitable, aggregate banking system capitalization would not decline. An analysis at the bank level reveals that based on the latest available RoA figures, no bank in Georgia, Qatar, or Tunisia would see negative profitability under the considered CBDC scenarios.[42] While overall banking systems remain profitable, individual banks with weak ex ante profitability could be adversely affected and thus regulators would need to monitor the entire distribution of banks.

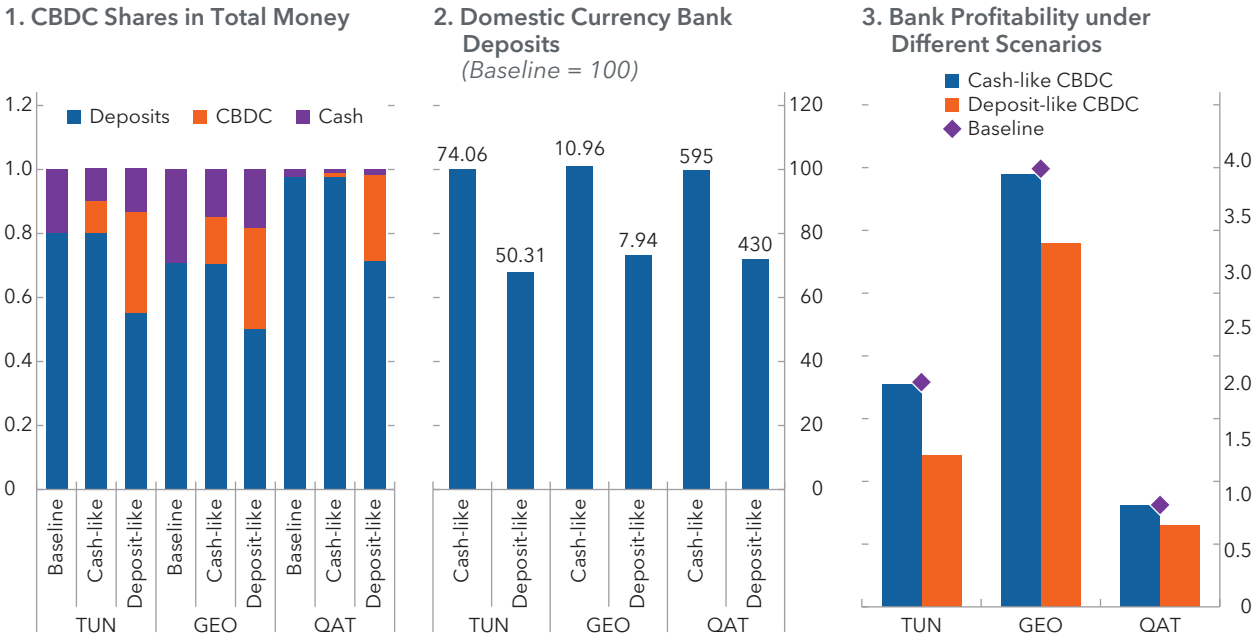
A cash-like CBDC unambiguously lowers central bank seigniorage, whereas the effect of a deposit-like CBDC on seigniorage depends on remuneration levels. The impact on the central banks' seigniorage depends on the remuneration of a CBDC and whether banks will increase borrowing from the central bank. If remunerated, a "cash-like" CBDC unambiguously lowers central bank profits, and the decline in central bank profits is increasing in the remuneration rate. This is because central bank income remains unaffected but expenses on a CBDC increase. If a CBDC is "deposit-like," the effect on central bank profits takes a hump shape. For low remuneration rates (25–50 percent of the policy rate), seigniorage is slightly increased as higher expenses on CBDC remuneration are outweighed by the central banks' increased revenue from reserve lending. However, as CBDC remuneration approaches 100 percent of the policy rate, the expenses on a CBDC outweigh the increased central bank revenue from reserve lending. The decline in seigniorage could reach up to 90 percent in the cash-reliant economies of Georgia and Tunisia. In Qatar, any impact would be more modest (peak seigniorage decline would be around 25 percent). In countries where seigniorage revenue is rebated to the ministry of finance, the changes in seigniorage could also have fiscal implications.

A CBDC may further affect financial stability or the exchange rate depending on design features, thus warranting additional analysis (Annex Figure 5.1). For example, a CBDC that is accessible to foreigners would reduce foreign deposits in Qatar by up to 26 percent. This would mitigate existing financial stability risks if the Qatari banking sector becomes less dependent on nonresident deposits. On the other hand, a CBDC accessible to foreigners would affect capital flows and potentially the exchange rate and could result in currency substitution. In the case of a peg, this might require additional interventions from the central bank. In the case of Georgia, the effects of a CBDC on the banking system and monetary policy partly depend on whether the CBDC would affect dollarization. Another example is the impact of CBDC on bank lending. A higher cost of funding after the introduction of a CBDC may imply higher lending rates[43] (a channel that is not incorporated in the model). Moreover, banks may have to shrink the size of their balance sheets, with an adverse impact on lending, if they cannot offset reductions in deposit funding. The impact of a CBDC on the quantity and costs of deposits may be attenuated by forces that are not modeled in this paper. For example, higher deposit rates could attract deposit flows into banks from wealthier households or a CBDC could strengthen financial inclusion. Hence, further analyses by the authorities may be needed.

[42] For the bank-level analysis, it was assumed that the decline in RoA for each bank equals the aggregate decline in RoA at the country level. Authorities may wish to conduct additional analysis that accounts for bank-level heterogeneity across other dimensions such as deposit dependence or noninterest income. The latest available RoA numbers were from 2022 for Georgia and Qatar and 2021 for Tunisia.

[43] This is corroborated in the academic literature; for example, Duquerroy, Matray, and Saidi (2022) show that higher funding costs feed into lower credit supply, higher loan rates, and more risk-taking.

Annex Figure 5.1. Financial Stability Implications of a CBDC



Source: IMF staff calculations using model by Gross and Letizia (2023).
Note: Panel 1 shows composition of total money across Georgia, Qatar, and Tunisia for three different scenarios. Panel 2 shows evolution of domestic currency bank deposits under the two counterfactual scenarios, with the baseline share normalized to 100. Numbers indicate the total quantity of domestic deposits in billions. Panel 3 shows banking system profitability, measured as systemwide return on assets. Data labels in the figure use International Organization for Standardization (ISO) country codes. CBDC = central bank digital currency.

CBDCs have the potential to strengthen the interest rate pass-through from policy rates to banks' cost of funding, depending on design features (Annex Figure 5.2).[44] Through the lens of the model, there are two main channels. First, CBDCs introduce additional competition for bank deposits, which induces banks to charge higher deposit rates and to respond more to an increase in policy rates. Second, banks' funding mix is affected by the introduction of a CBDC. In the absence of CBDCs, banks are primarily deposit financed in the model, which corresponds to the empirical observations for ME&CA countries. After a CBDC is introduced in the model, banks partly substitute into more expensive reserve borrowings from the central bank to offset the decline in deposits. Since the cost of reserve borrowings is the policy rate, this funding has a 100 percent interest rate pass-through when policy rates rise.

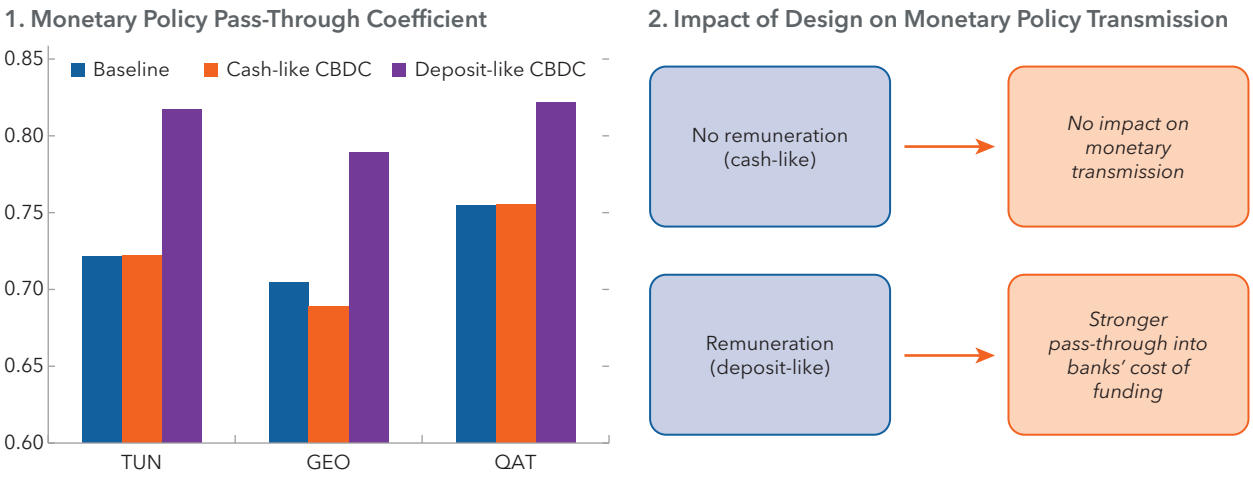
While an unremunerated CBDC does not affect interest rate pass-through, a remunerated CBDC strengthens interest rate pass-through in all three country cases. For the counterfactual analysis, three scenarios are considered in each country. The first scenario is the baseline in the absence of a CBDC. The second scenario has an unremunerated CBDC, which captures a CBDC that is more similar to cash. The third scenario considers a fully remunerated CBDC, which is more akin to deposits. Interest rate pass-through is then defined as the pass-through from higher policy rates—in the model, a 100 basis point increase in the policy rate is simulated—into banks' cost of funding consisting of both deposit and reserve borrowing expenses.

An unremunerated CBDC has no impact on monetary policy pass-through. An unremunerated CBDC has no impact on the pass-through from policy rates into banks' funding costs as the pass-through coefficients are statistically indistinguishable from the baseline coefficient.[45] This is because an unremunerated CBDC does not materially affect banks' funding mix. Under the assumption that it is cash-like, it does not compete

[44] Here and in the remainder, monetary policy pass-through exclusively refers to the pass-through from changes in policy rates into banks' cost of funding.

[45] While the distributions in Georgia do not perfectly overlap, this is due to sampling uncertainty. There is substantial overlap between the distributions, and the difference is not statistically significant.

Annex Figure 5.2. Interest Rate Pass-Through of Monetary Policy into Banks' Cost of Funding



Source: IMF staff calculations using model by Gross and Letizia (2023).
Note: Panel 1 reports estimated mean coefficient of monetary policy pass-through under 1,500 model simulations of the model from Gross and Letizia (2023). Coefficient measures change in banks' cost of funding as a fraction of change in the policy rate. Data labels in the figure use International Organization for Standardization (ISO) country codes. CBDC = central bank digital currency.

with deposits. Even when assumed deposit-like, the difference in remuneration rates between CBDC and bank deposits implies low take-up of CBDC and thus no measurable effect on interest rate pass-through into banks' cost of funding.

A remunerated CBDC has the potential to strengthen interest rate pass-through. A remunerated CBDC implies a statistically significant increase in banks' cost of funding in all three countries by between 7 and 10 additional basis points for a 100 basis point increase in the policy rate, highlighting how a CBDC can increase the strength of monetary policy pass-through into banks' cost of funding. The increase in interest rate pass-through is slightly larger in Georgia and Tunisia where the baseline pass-through is lower. Hence, countries with comparatively weaker monetary policy pass-through may see larger increases in interest rate pass-through. While monetary policy could become more effective in ME&CA countries if a CBDC is introduced, banks may be more adversely affected by monetary tightening as their cost of funding becomes more sensitive to the policy rate. The more adverse effects of monetary tightening on banks' funding cost could adversely affect banks with weak profitability or with a high share of fixed rate loans that do not reprice when rates increase.

Results need to be interpreted cautiously as several channels of monetary policy transmission are not explicitly modeled. For ME&CA countries with a floating exchange rate regime, the exchange rate channel of monetary policy is one of the main transmission channels. Another key left-out channel is the bank lending channel. In exchange rate peggers, particularly GCC economies, there is significant pass-through from higher policy rates into higher bank lending rates and lower credit volumes. The increase in lending rates partly mitigates or could fully offset the decline in net interest margins from higher funding costs. Hence, additional modeling work is needed to understand the impact on monetary policy transmission more precisely, and how the introduction of a CBDC would ultimately affect transmission from policy rates into output and inflation.

Authorities should also carefully evaluate the impact of design features on monetary policy pass-through under a CBDC. The analysis showed that a remunerated CBDC is likely to strengthen monetary pass-through to an extent, whereas an unremunerated cash-like CBDC is estimated not to have an effect. The impact on

monetary transmission likely also depends on the scope of CBDC adoption and network effects. If a CBDC is introduced with a tight cap on the amount of CBDC holdings per person, the impact on monetary policy pass-through may be smaller as compared to a CBDC that households can hold in unlimited amounts.

Future work on CBDCs in the region could consider their impact on financial inclusion, cross-border flows, dollarization, and spillovers. For example, Banet and Lebeau (2022) highlight how a CBDC, especially if it has low user costs, can significantly increase financial inclusion even for low levels of remuneration, while Tan (2023) shows that deposit outflows into CBDCs may be offset by greater financial inclusion so that overall deposits (and lending) may increase after introducing a CBDC. Moreover, while the introduction of CBDCs may accentuate international spillovers, these effects may be dampened depending on design choices, particularly by restrictions on usage by foreigners, limits to holdings, and absence of remuneration (see Ferrari Minesso, Mehl, and Stracca 2022). A relatively higher preference for cash in several ME&CA countries also dampens this channel. Dollarization is another prevalent feature of economies in the ME&CA region that could be incorporated when studying the impact of CBDC implementation. Other aspects that could be considered for research include the impact of different design features of CBDCs, such as caps on CBDC holdings or the effect on lending rates.

Additional research could also focus on the implications of remunerated CBDC adoption. Research on the wide-ranging implications of CBDCs is still evolving and is limited to structural models. While the focus of this paper is the unremunerated CBDC, Annex 5, using the quantitative structural model of Gross and Letizia (2023), aims to illustrate the implications of introducing a CBDC (assuming various degrees of remuneration) on financial stability and monetary policy pass-through for three country cases: Georgia, Qatar, and Tunisia.

Georgia

Macrofinancial Parameters

Georgia is a highly cash-reliant economy (cash share of 22.5 percent) with significant dollarization and low pass-through from the policy rate to deposit rates. Dollarization of deposits stood at 55 percent in 2022 and loan dollarization at 40 percent. Both have been on a downward trend following active de-dollarization measures by the National Bank of Georgia, such as not remunerating foreign exchange reserves but only local currency reserves. Deposit rates stand at 5.03 percent while the policy rate was 10.5 percent at the end of 2021. The low pass-through from policy rates to deposit rates is captured by the model's low-price sensitivity of deposits ($\beta = 25$).

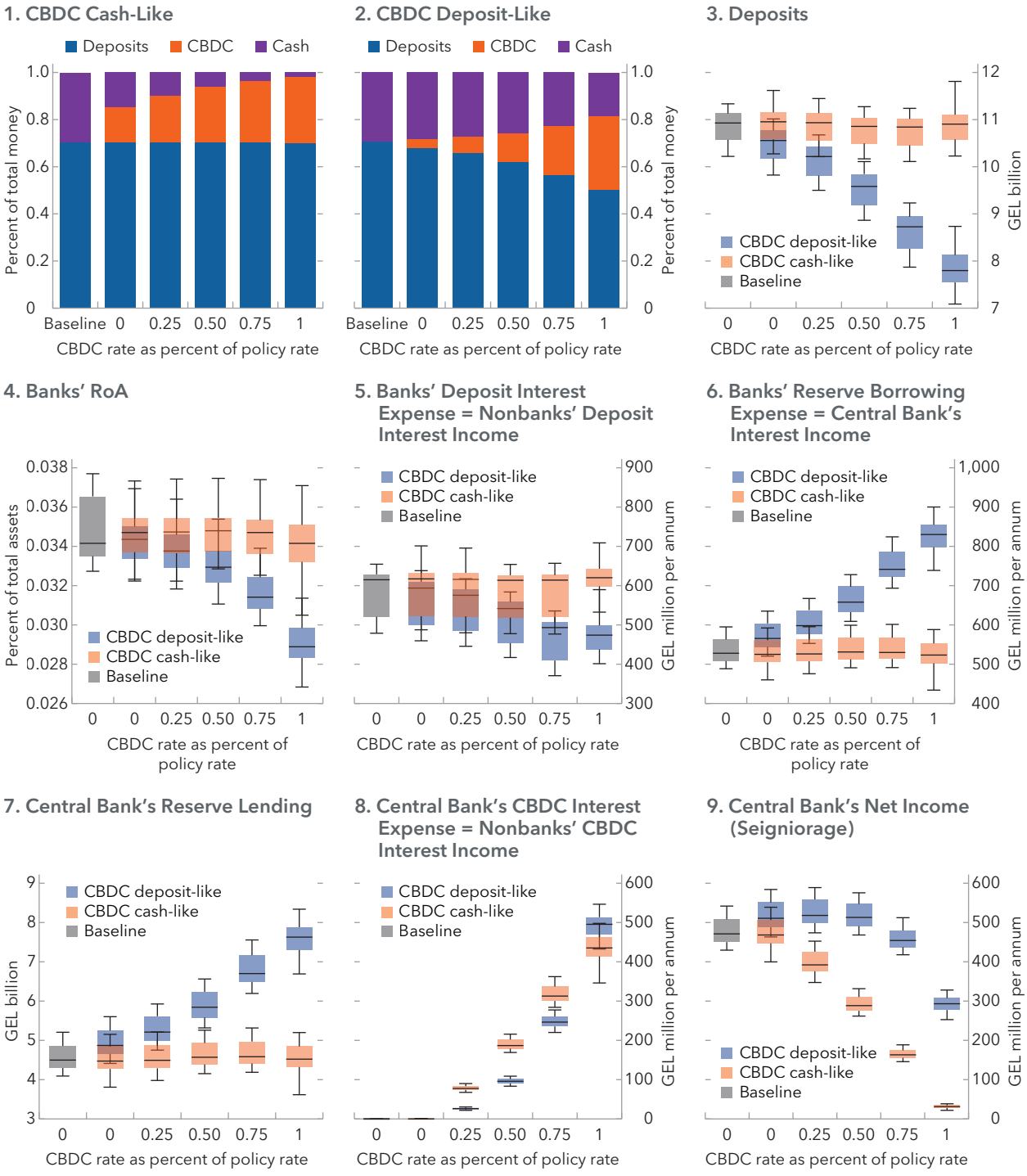
The banking sector is highly concentrated, deposit-reliant, and profitable. The market is dominated by JSC Bank of Georgia and TBC Bank, with the top four banks covering 85 percent of the market. A total of 80 percent of banks' nonequity funding comes from deposits, which are almost exclusively stable customer deposits. Low competition and relatively cheap deposit funding drive an aggregate net interest margin of 5.4 percent, which underlines the high profitability of the Georgian banking sector.

Results

A CBDC could attain a nonnegligible share of total money, competing with deposits and cash (Annex Figure 5.3). Even in the absence of remuneration, a cash-like CBDC would reduce the share of cash by half in Georgia. In contrast, a deposit-like CBDC would exhibit a relatively low adoption rate (< 5 percent) if moderately remunerated. A deposit-like CBDC that is remunerated at the prevailing policy rate would attain a share of more than 30 percent of total money, leading to a significant drop in deposits (by more than 30 percent).

The decline in deposits in the case of a remunerated CBDC would lead banks to increase their borrowing from the central bank. Borrowing from the central bank would increase by 4 billion lari. This reallocation is particularly pronounced when CBDC is remunerated at or close to (75 percent) the policy rate. When a CBDC

Annex Figure 5.3. Georgia Figures



Source: IMF staff calculations.
Note: Gray bars in box plots indicate current baseline in the absence of a CBDC. Orange box plots indicate impact of cash-like CBDC across different remuneration scenarios. Blue box plots show impact of a deposit-like CBDC across remuneration scenarios.
CBDC = central bank digital currency; RoA = return on assets.

is cash-like, it has no impact on deposit funding for banks as it does not directly compete with deposits. The deposit rate would rise from 5.03 percent to about 6 percent if the CBDC was deposit-like and remunerated at the policy rate. While deposits fall and the deposit rate rises, the net effect is a decline in banks' interest expenses. Reduced deposit funding is offset by an increase in reserve borrowing from the central bank.

The increase in deposit rates also strengthens monetary policy pass-through. Baseline pass-through is around 70 percent, reflecting the relatively high concentration of the domestic banking sector as well as low interest rate sensitivity of deposits. Competition from a CBDC would increase pass-through to about 79 percent in the case of a deposit-like CBDC with full remuneration. Hence, introducing a CBDC has the potential to increase monetary policy pass-through in Georgia as it indirectly increases competition for the banking sector, which in turn induces banks to pass on more of the policy rate increase into deposit rates.

Overall, there is a reduction in banks' net income. Deposit expenses fall from 0.6 to 0.4 billion lari. However, expenses on reserve borrowing rise by 0.4 billion lari, implying a reduction in net income of 0.2 billion lari, or close to 37 percent. Systemwide RoA would drop from about 3.4 percent to 2.9 percent. Hence, banks would remain comfortably profitable. At the same time, the substantial reduction in RoA could trigger increases in bank risk-taking or increases in loan rates. Such second-round effects of introducing a CBDC and their impact on credit provision need to be carefully evaluated before potentially introducing a CBDC.

A cash-like CBDC always reduces seigniorage, whereas a deposit-like CBDC can raise central bank revenue when remuneration is low. Under a cash-like CBDC, borrowing from the central bank is not affected as banks' funding mix remains stable. However, if the central bank remunerates the cash-like CBDC, its expenses rise so seigniorage declines. In the case of a remunerated deposit-like CBDC, there are two opposing effects. On the one hand, remuneration decreases central bank net income. On the other hand, the increased demand for borrowing from the central bank raises central bank net income. Taken together, moderate remuneration of a deposit-like CBDC leads to a slight increase in seigniorage. Remuneration at the policy rate would instead also lead to a decline of close to 40 percent in seigniorage. This has implications for the Treasury as seigniorage could fall from currently about 0.5 billion lari to close to zero in the most adverse scenario where CBDC is cash-like and fully remunerated.

Overall, a CBDC has the potential to accelerate the transition to electronic payments in Georgia by reducing cash reliance; further research would be beneficial. A CBDC could achieve an adoption rate of up to 30 percent depending on design features and adoption. At the same time, high CBDC adoption rates could imply an outflow of deposits, when the CBDC is remunerated and perceived as deposit-like. This could benefit consumers in the form of higher deposit rates as banks' market power is curtailed. But domestic banks could come under pressure from declining net interest margins, which warrants further work on how lending rates may respond to the introduction of a digital lari. Moreover, the macroprudential framework required for a CBDC—including robust capital regulation and liquidity buffers—requires additional analytical work. Another area for more research is the impact of introducing a domestic CBDC on dollarization.

Qatar

Macrofinancial Parameters

Qatar is a financially advanced oil exporter. Credit to GDP stands at 209 percent, and the country serves as a regional financial center. The high level of financial development is reflected in the low share of cash, which stands at 2.18 percent of M2.

Qatari banks primarily fund themselves with deposits, including a sizable share of foreign deposits. The deposit share stands at 86 percent of nonequity funding, with foreign deposits making up 30 percent of total deposits (IMF 2022a). Despite high levels of concentration—the largest bank alone accounts for 56 percent of assets—deposit lending spreads stood at 2.7 percent in 2021 and deposit rates were 74 percent of the policy rate on average over the past decade.

Results

To account for foreign deposits, two sets of counterfactuals are estimated for Qatar (Annex Figure 5.4). In the first set of results, the implicit assumption is that foreign deposits are unaffected by the introduction of a CBDC. Hence, the foreign deposit share does not respond to the different CBDC scenarios.

In the second set of counterfactuals, the assumption is made that foreign deposits are equally affected as domestic deposits (Annex Figure 5.5). Hence, the impacts of a CBDC on deposit intermediation are larger.

For a CBDC to affect money shares in Qatar, it needs to have deposit-like features, given the low cash share. A cash-like CBDC never exceeds a 2 percent share of total money. A deposit-like CBDC could attain up to 30 percent share in M2 if remunerated at the policy rate. Given the relatively low policy rate–deposit rate spread in Qatar, a deposit-like CBDC at lower rates of remuneration achieves considerably lower shares. For example, when remunerated at 75 percent of the policy rate, the CBDC share in total money is about 12 percent.

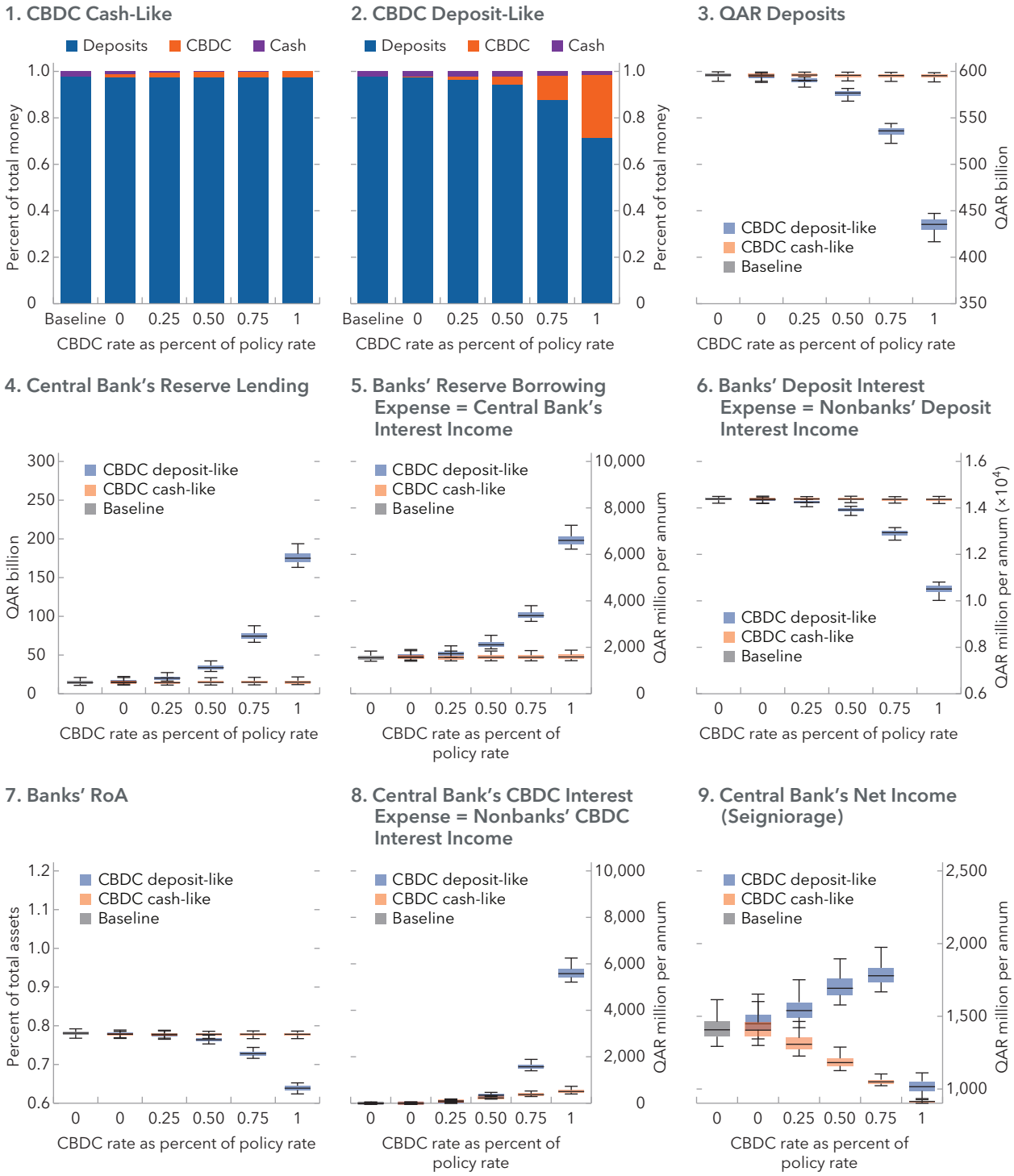
Deposits could decline by more than 200 billion Qatari riyal as depositors substitute into a CBDC. The deposit decline is highly dependent on design features and strongest when a CBDC is deposit-like and remunerated. The maximum deposit decline is about 150 billion Qatari riyal (25 percent of domestic deposits) when foreign deposits are assumed unaffected by the introduction of a CBDC and 220 billion Qatari riyal (26 percent of total deposits) when foreign deposits are also partially disintermediated by a CBDC.

Reduced deposit funding would be compensated for by increased borrowing from the central bank. Reserve borrowing would increase by between 150 and 220 billion Qatari riyal if the CBDC is deposit-like and fully remunerated. For the central bank, this implies revenues from reserve lending between 6.5 and 9 billion Qatari riyal.

The increase in banks' funding cost would reduce their profitability, but banks remain profitable in all scenarios. A cash-like CBDC does not affect bank profitability as it does not affect deposit rates. When a CBDC is deposit-like and remunerated, the additional competition from the CBDC induces banks to raise deposit rates. Since the deposit-policy rate spread is relatively low in Qatar, the decline in RoA due to the CBDC remains below 0.1 percentage point even for a deposit-like CBDC with 75 percent remuneration. A fully remunerated CBDC would decrease RoA by about 25 percent. Hence, the Qatari banking system would remain profitable; additional bank-level analysis would be valuable.

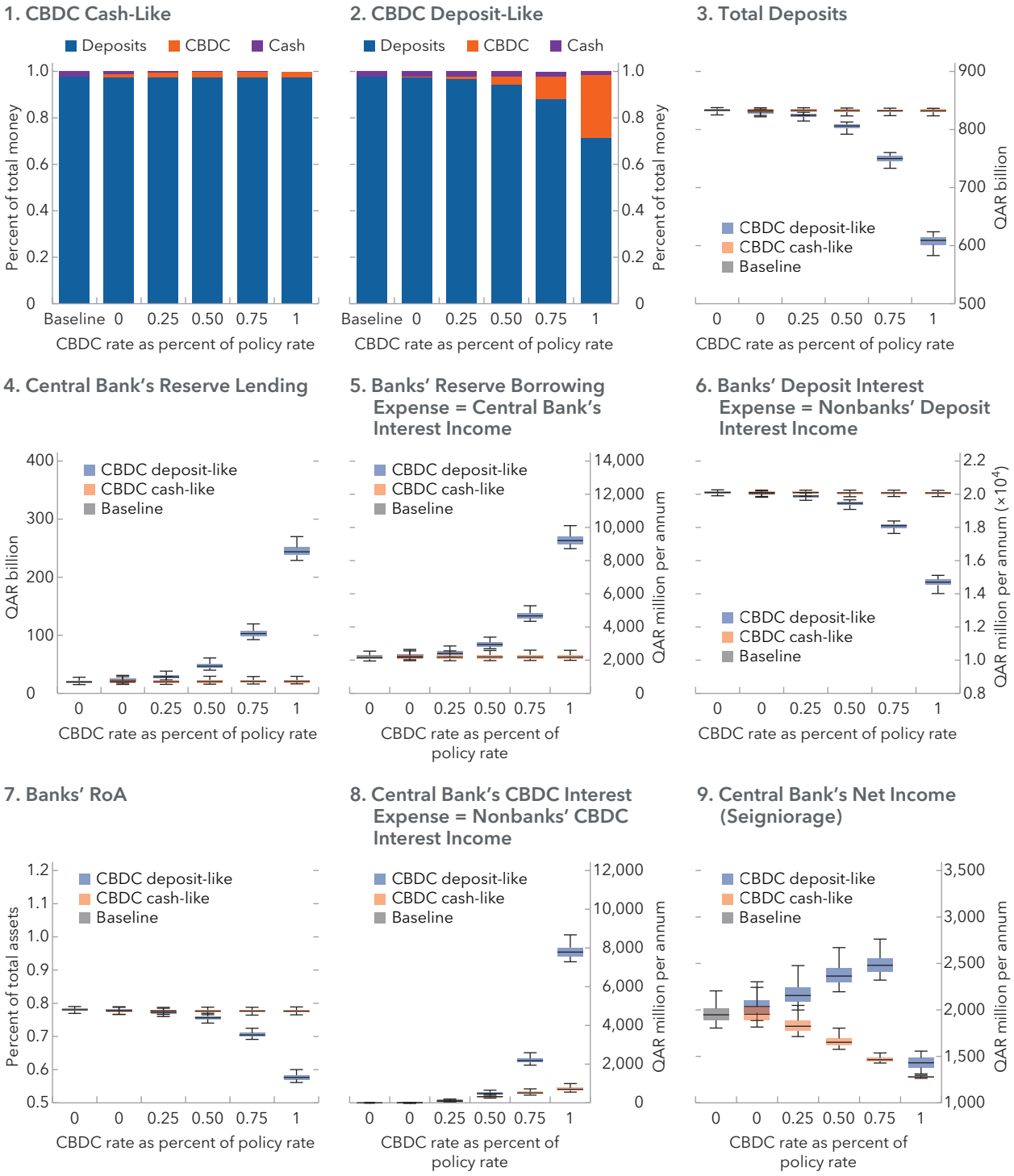
While a cash-like CBDC always reduces seigniorage, a deposit-like CBDC could increase central bank revenue, depending on design features. A cash-like CBDC would reduce seigniorage by up to one-third, with the effect being larger for higher rates of remuneration. With a deposit-like CBDC, seigniorage would increase even when the remuneration rate is set at 75 percent of the policy rate. This is because CBDC take-up would be relatively low, implying modest increases in the central bank's interest expenses, that are more than offset by the additional revenues from reserve lending. When remuneration is 100 percent of the policy rate, seigniorage would decline by more than 25 percent as CBDC interest expenses outweigh revenue from reserve lending. Overall, the potential adverse impact on seigniorage is smaller than in Georgia or Tunisia because of the low cash share of the Qatari economy.

Annex Figure 5.4. Qatar Figures: Scenario 1 (CBDC Does Not Compete with Foreign Deposits)



Source: IMF staff calculations.
Note: All deposit figures shown here refer exclusively to domestic deposits. CBDC = central bank digital currency; RoA = return on assets.

Annex Figure 5.5. Qatar Figures: Scenario 2 (CBDC Does Compete with Foreign Deposits)



Source: IMF staff calculations based on Gross and Letizia (2023).
Note: All deposit figures and numbers shown here include both foreign and domestic deposits. CBDC = central bank digital currency; RoA = return on assets.

A CBDC could reduce the share of foreign deposits if it has deposit-like features and foreign ownership is allowed. In that case, foreign depositors would face a portfolio choice between deposits and the CBDC. The model predicts a decline of foreign deposits by 26 percent (255 billion to 188 billion Qatari riyal). This would lower the financial stability risks stemming from foreign depositor flight but come at an additional cost to the central bank of more than 2.5 billion Qatari riyal through interest expenses on the CBDC.

More work is needed. The authorities may wish to conduct further analysis on several questions. For Qatar, the impact of a CBDC on foreign deposits is of particular interest because it has potential implications for both financial stability and the exchange rate. Related to this, design features such as whether to allow foreigners to hold a CBDC are critical determinants of the impact of a CBDC on the banking system. Moreover, estimates suggest that a CBDC could increase the pass-through from policy rates into banks' cost of funding from 75 to 82 percent. Additional research could help to ascertain the impact of CBDC on lending rates and credit provision.

Tunisia

Macrofinancial Parameters

Tunisia is a cash-reliant economy (18.7 percent share in total money) with a moderate price sensitivity of deposits. The sensitivity of deposits to the deposit rate is estimated at 55 (higher than in Georgia and slightly higher than in the United States but significantly lower than in the euro area based on estimates from Gross and Letizia 2023). The policy rate stood at 6.5 percent at the end of 2021 with an average deposit rate of 4.1 percent.

Tunisian banks primarily fund themselves with deposits and display healthy profitability, on the back of sizable policy rate–deposit spreads. Deposits account for 92 percent of total nonequity funding. Deposit-lending spreads around 2.7 percent support profitability. The banking sector has a relatively lower degree of concentration (53 percent of asset at the top four banks) than other countries in the region, which is reflected by the estimated number of banks (B = 6, higher than in relatively more concentrated Georgia).

Results

A CBDC could attain a significant share of total money supply in Tunisia. Depending on remuneration, a cash-like CBDC could account for up to 18 percent of the total money stock, and a deposit-like CBDC could capture a market share of up to 25 percent. Even if nonremunerated, a cash-like CBDC is estimated to capture a 9 percent market share in the cash-reliant economy of Tunisia. For a deposit-like CBDC, its market share grows significantly in the remuneration rate as a deposit-like CBDC competes more closely with deposits when more remunerated.

While a deposit-like remunerated CBDC would lead to falling deposits, a cash-like CBDC has no impact on banks' deposit funding. At low rates of remuneration (25–50 percent of the policy rates), deposits decline modestly by 2 to 6 percent. If fully remunerated, deposits would decline by about one-third under a deposit-like CBDC, from about 75 billion Tunisian dinar to about 50 billion. Price sensitivity is one of the key drivers for substitution between deposits and CBDC when CBDC is deposit-like.

To limit the outflow of deposits, banks raise their deposit rates in response to the competition from a remunerated CBDC. The deposit rate in Tunisia would increase slightly from 4.1 percent to 4.2 percent. This increase is relatively more modest than in other countries because the deposit rate in Tunisia is relatively closer to the reserve borrowing rate than in Georgia, for example. Taken together, the decline in the quantity of deposits outweighs the rise in the deposit rate so that banks' deposit expenses decline.

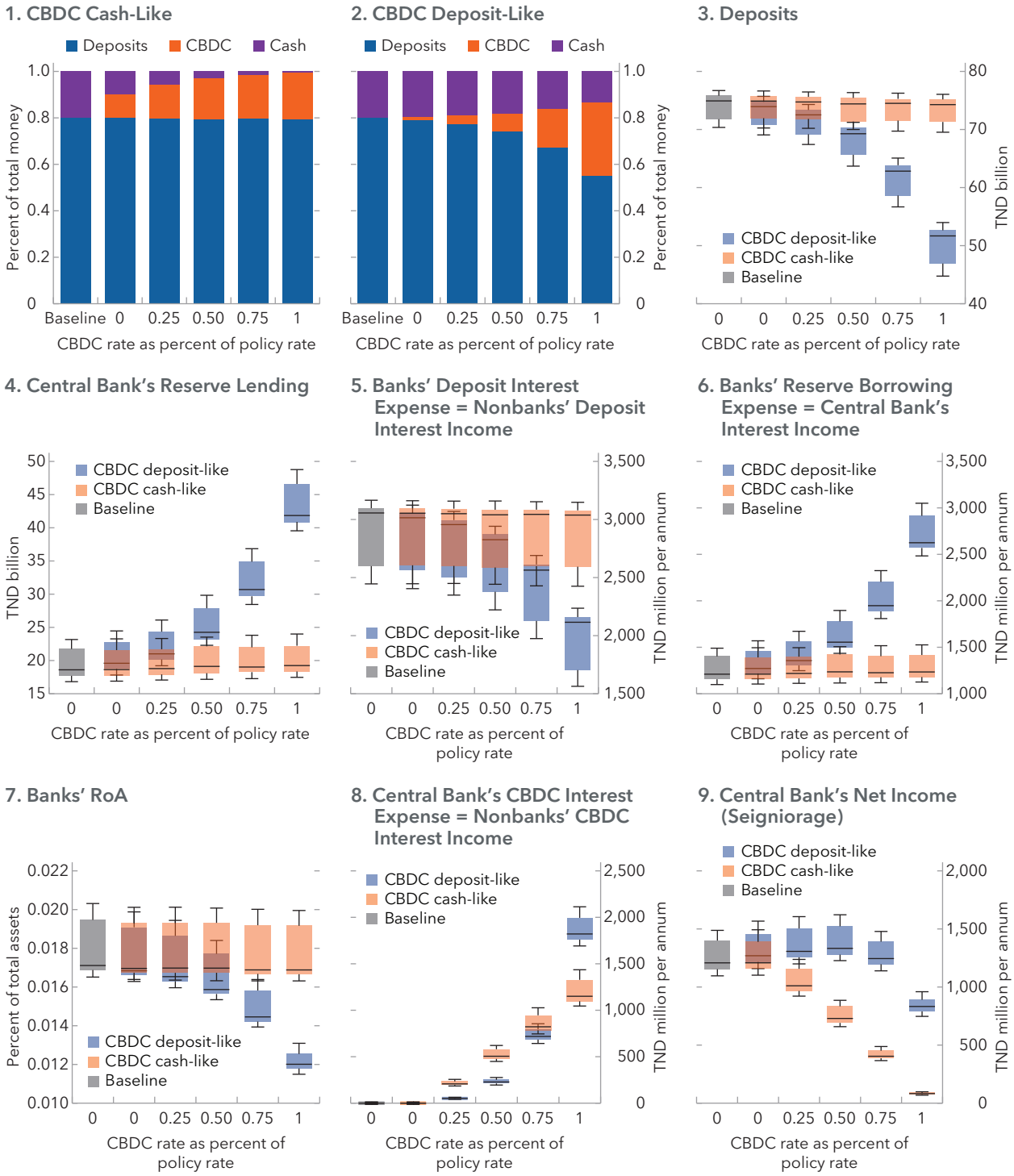
To compensate for the decline in deposit funding, banks would increase their borrowing from the central bank. As deposits and reserve borrowings are the only funding sources in this model, given the decline in deposits, banks substitute toward increased reserve borrowing from the central bank. Specifically, in the scenario of a fully remunerated, deposit-like CBDC, banks would borrow an additional 20 billion Tunisian dinar from the central bank to maintain stable funding. While other funding sources, such as wholesale funding, are not explicitly considered in the model, the role of wholesale funding in Tunisia is small due to underdeveloped secondary market and a small nonbank financial sector. Hence, it is unlikely that wholesale funding sources could accommodate banks' funding needs if deposits were to decline materially.

Banks' net income would ultimately decline as the increase in deposit rates and greater central bank reserve borrowing both reduce net income, but banks remain significantly profitable. While the decline in deposits would lead to a reduction of up to 1 billion Tunisian dinar in deposit expenses—despite the increase in deposit rates—this is offset by an increase of up to 1.5 billion Tunisian dinar in expenses on reserve borrowings from the central bank. Taken together, these two effects imply a reduction in net income by up to 500 million Tunisian dinar (from a level of 1.6 billion Tunisian dinar). RoA would decline from 1.6 percent to 1.2 percent in the most impactful scenario of a deposit-like and fully remunerated CBDC. Other scenarios—either a lower remuneration rate or a cash-like CBDC—imply a lower reduction in banks' profitability. In either scenario, banks remain profitable. Further analysis regarding the heterogeneous impact of a CBDC across individual banks would be valuable for the authorities.

A cash-like CBDC unambiguously lowers central bank seigniorage, whereas the effect of a deposit-like CBDC on seigniorage depends on remuneration. Seigniorage would decline by up to 35 percent in the case of a deposit-like CBDC and up to 90 percent if the CBDC is cash-like. The key determinants for the impact on the central bank's finances are the remuneration of the CBDC and whether banks will increase borrowing from the central bank. If remunerated, a cash-like CBDC unambiguously lowers central bank profits, and the decline in central bank profits is increasing in the remuneration rate. This is because central bank income remains unaffected but expenses on a CBDC increase. If, instead, CBDC is deposit-like, the effect on central bank profits is theoretically ambiguous and empirically takes a hump shape. For remuneration rates up to 75 percent of the deposit rate, a deposit-like CBDC leads to a slight increase in seigniorage. The increased expenses on CBDC remuneration are outweighed by the central bank's increased revenue from reserve lending as commercial banks turn to the central bank to outweigh the outflow of deposits. A fully remunerated CBDC instead leads to a decline in seigniorage by more than 200 million Tunisian dinar.

There is significant scope for CBDC adoption in Tunisia, and authorities may wish to conduct further in-depth analysis as they explore the introduction of the e-Dinar (Annex Figure 5.6). A CBDC could attain a 2 to 30 percent share in total money. These likely represent lower and upper bounds. Depending on CBDC design features, the introduction of a CBDC has the potential to significantly lower the cash dependence of the Tunisian economy. While Tunisian banks remain profitable in all scenarios, a deposit-like highly remunerated CBDC significantly reduces bank profitability (by close to one-third), which could lead to increasing lending rates or, in a downside scenario, trigger increased risk-taking by banks. Further analysis by the Central Bank of Tunisia could be beneficial. For example, estimates suggest that a CBDC would increase monetary policy pass-through from 0.72 to 0.82, which may contribute to higher monetary policy effectiveness in Tunisia. The extent to which this effect may be dampened by forces outside the model (for example, price subsidies or subsidized lending schemes) would be a promising avenue for future research.

Annex Figure 5.6. Tunisia Figures



Source: IMF staff calculations.
Note: Gray bars in box plots indicate current baseline in the absence of a CBDC. Orange box plots indicate impact of cash-like CBDC across different remuneration scenarios. Blue box plots show impact of a deposit-like CBDC across remuneration scenarios. CBDC = central bank digital currency; RoA = return on assets.

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