KINGDOM OF BAHRAIN

SELECTED ISSUES

September 2023

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KINGDOM OF BAHRAIN

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FINANCIAL SYSTEM EFFECTS OF INTRODUCING A CBDC IN BAHRAIN—A COUNTERFACTUAL ANALYSIS

Interest in CBDC is growing globally including in Bahrain, which has made considerable strides in the areas of payment service digitalization and fintech. While a CBDC could bring about various benefits, it may also imply risks. The analysis presented in this paper aims to assess some of these benefits and risks for Bahrain. It will quantify the potential impact of introducing a CBDC on the financial system and monetary policy transmission using a model specifically calibrated and estimated for Bahrain. It finds that a CBDC's perceived utility by the population is key for wide adoption. While high adoption and remuneration can help enhance monetary policy transmission, they may imply a drag on banking system profitability. A careful and analytically informed design could enhance adoption while limiting risks to financial stability.

A. Context

1.   Global interest in CBDCs keeps growing. Almost 90 percent of central banks globally are currently engaged in CBDC-related work;[1] of which more than half have advanced beyond the research stage with the share of countries developing or piloting a CBDC doubling in each of the past two years.[2] Eleven countries have, as of mid-March 2023, introduced a CBDC: the Bahamas, Jamaica, Nigeria, and eight countries of the Eastern Caribbean.

2.   The motives for considering CBDCs are multi-faceted and dependent on a country's initial conditions.[3] These can be summarized along six dimensions (Figure 1): (1) fostering financial inclusion; (2) strengthening competition and reducing monopolistic rents in banking systems and e-money service provider markets, where competition is initially limited; (3) enhancing payment systems' operational resilience by reducing concentration; (4) helping to combat the illicit use of money, e.g., tax evasion, money laundering and terrorist financing; (5) strengthening monetary policy pass-through; and (6) preserving monetary sovereignty amid a potentially growing use of

Figure 1. Bahrain: Policy Goals of Introducing CBDCs

Note: Policy goals of CBDC as summarized in Gross and Letizia (2023, Section 2).

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[1] Bank for International Settlements, 2022, "Gaining momentum – Results of the 2021 BIS Survey on Central Bank Digital Currencies," BIS Paper No. 125, Basel, Switzerland.
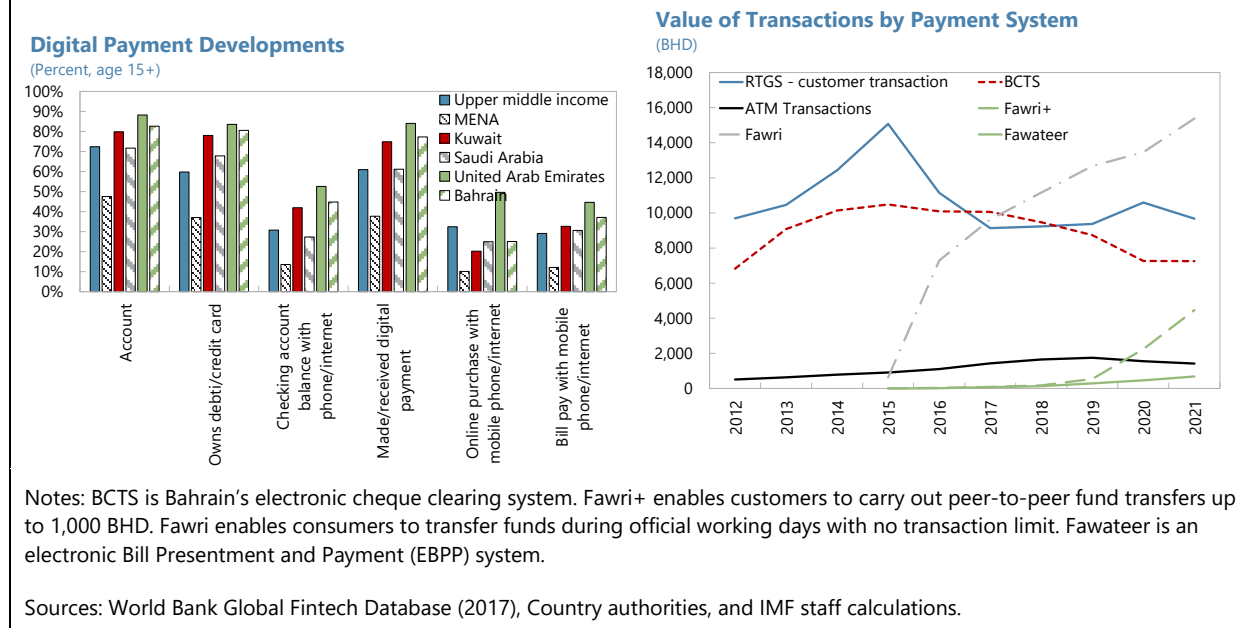
[2] Atlantic Council CBDC Tracker (2023).

[3] For useful overviews and discussions of the reasons for considering CBDCs, various BIS survey papers are useful to consult, e.g., BIS 2021, "Central Bank Digital Currencies: User Needs and Adoption," Report No. 3; BIS 2021, "Central Bank Digital Currencies: Financial Stability Implications," Report No. 4; BIS 2022, "Gaining Momentum—Results of the 2021 BIS Survey on Central Bank Digital Currencies," Report No. 125.

private crypto assets or the cross-border use of other countries' CBDCs. Countries with more developed financial systems and high levels of financial inclusion, akin to Bahrain, are particularly interested in enhancing the resilience and competition in payment systems while preserving monetary sovereignty and strengthening the transmission of monetary policy.

3.   Bahrain has made significant strides in the areas of fintech and the adoption of digital payments. According to the World Bank Global Fintech Database, Bahrain was already a leader compared to the region and upper middle-income countries in 2017, with about 80 percent of the surveyed sample of the population having made use of digital payments. Since then, Bahrain has taken significant regulatory steps to create a favorable environment for fintech, including the introduction of a fintech unit at the Central Bank of Bahrain (CBB), a regulatory sandbox, and new regulations for the digitalization of banking and payment services. Digital payment service solutions, such as mobile payment apps, contactless payment cards, and e-wallets, have been introduced and were adopted by the population to a notable extent, particularly since the COVID pandemic.[4] A large payments solution, called Fawri, for businesses has already overtaken the use of cheques and bank transfers, while a small-denomination instant payment solution, Fawri+, surpassed ATM transactions (Figure 2).

4.   Bahrain's interest in CBDC dates back to 2018, with the launch of the Digital Dinar (E-Dinar) project. The CBB's motivations in considering CBDC lie in alleviating payment system pressure points and in meeting the growing demand for digital payments by all market segments at reduced cost and enhanced speed. The authorities have been looking into the general benefits and risks from the introduction of a CBDC in the literature as well as other country experiences. A technical committee was set up to assess the design options and technology features that would support the CBB's objectives. In February 2022, the CBB prepared a concept note formulating its objectives and desired characteristics of a retail/wholesale CBDC, a potential architecture and technological design, as well as a roadmap for piloting and implementation.

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[4] TradeArabia News Service, "Bahrain emerges leader in adoption of real-time payments", TradeArabia, April 12, 2021.

Figure 2. Bahrain: Fintech and Digital Payments Developments

Digital Payment Developments
(Percent, age 15+)

Value of Transactions by Payment System
(BHD)

Notes: BCTS is Bahrain's electronic cheque clearing system. Fawri+ enables customers to carry out peer-to-peer fund transfers up to 1,000 BHD. Fawri enables consumers to transfer funds during official working days with no transaction limit. Fawateer is an electronic Bill Presentment and Payment (EBPP) system.

Sources: World Bank Global Fintech Database (2017), Country authorities, and IMF staff calculations.

B. Analytical Assessment of the Impact of CBDC on Financial System Dynamics in Bahrain

The Model

5.   **The model-based analysis in this section aims to assess the impact of introducing a CBDC on the financial system.** The model developed by Gross and Letizia (2023) (henceforth GL 2023) was calibrated and estimated for Bahrain.[5] By simulating counterfactual scenarios which introduce a CBDC, the model attempts to provide indicative answers to the following questions: (1) What potential demand for CBDC as a share of total money may arise? (2) To what extent would a CBDC replace bank deposits, thereby increasing banks' reserve borrowing needs from the central bank? (3) What impact would CBDC-induced competition have on the spread of bank deposit rates to the policy rate? (4) How would bank and central bank interest income and expenses (and hence net seigniorage gains) be affected? (5) What impact could a CBDC have on monetary policy pass-through? Besides providing quantitative answers to such questions, the model aims to help shape an understanding of the interplay between the characteristics of the financial system and the various impact channels that determine the consequences of introducing a CBDC.

6.   **The model is structural, yet strongly rooted in macro-financial data.** The model is comprised of three types of agents: banks, a central bank, and non-banks (the latter representing

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[5] Gross, M., and E. Letizia. 2023. "To Demand or Not to Demand: On Quantifying the Future Appetite for CBDC." IMF Working Paper No. 23/9, International Monetary Fund, Washington DC. The model codes are available online on the IMF working paper page.

households, nonfinancial and non-bank financial firms, and the sovereign). Non-banks decide the composition of their money holdings (cash, deposits, and CBDC once introduced) to maximize their utility.[6] The utility for each form of money has two contributions: (1) an interest-implied utility that is influenced by an interest sensitivity parameter, and (2) a so-called "base utility" which captures the utility stemming from factors other than interest, such as the ease of making payments or the risk-free nature of central bank liabilities (cash and CBDC). Banks are maximizing profits in the model by choosing profit-maximizing deposit rates. The model simulates the integrated balance sheets and financial flows of all agents, while adhering to a stock-flow consistency principle. This is instrumental for capturing all monetary stocks and flows with a *full system* perspective as an accounting basis, upon which the economics of the model are built.

7. **The model abstracts from several CBDC design choices.** These include the underlying technology and other features such as anonymity, off-line operability, and tiering schemes for remuneration. As the model is comprised of one economy, cross-border aspects are not addressed. Further, no caps on CBDC holdings or flows are considered in the model. Such and other features can influence the perceived attractiveness of a CBDC compared to other forms of money and hence affect its take-up with implications for the financial system.

Model Calibration and Estimation

8. **The model is calibrated and estimated to match key features of the Bahraini economy**. The required data inputs include: (1) the total money stock, (2) currency in circulation, (3) bank deposit rates, (4) central bank policy parameters, and (5) nominal GDP. The policy parameters comprise reserve requirements, reserve remuneration rates for required and excess reserves, and reserve

borrowing rates. Various model parameters are directly aligned with empirical counterparts, such as the central bank policy parameters, and the velocity of money (defined as nominal GDP over the total money stock). Some remaining parameters are then estimated to let the model match selected key features of the economy, namely (i) an initial level of competition in the Bahraini financial system (reflected by observed deposit-policy rate spreads), and (ii) the Bahraini population's preference for holding cash despite it not paying any interest (reflected by observed cash-in-total-money ratios). Furthermore, the population's estimated sensitivity to interest rate changes is an embedded model parameter. To allow the model outcomes to be interpretable with regard to real world quantities, the empirical money stock in the model is scaled to Bahrain's monetary aggregate M3 at end-2022.

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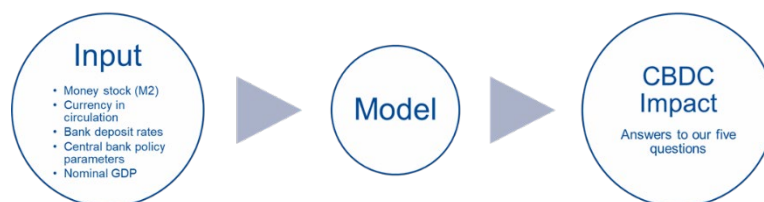
[6] Non-banks' utility function follows a so-called Random Utility Model (RUM) structure, in turn represented by a conditional logit model that captures the utility that non-banks derive from holding and transacting their money in different forms. The utility function is defined as: $u_{nb} = \underbrace{\alpha_b + i_b\beta}_{\equiv v_b} + \varepsilon_{nb}$, where α_b denotes the "base utility"

and $i_b\beta$ is the utility stemming from the interest income implied by the rates, i_b, and non-banks' price sensitivity, β. The rates, i_b, are non-negative for the banks, zero for cash, and may be zero or positive for CBDC.

The net income effects from the model will be attached to an aggregate return on asset (RoA) ratio for Bahrain's banking system. Figure 3 summarizes some relevant data for Bahrain that informed the calibration and estimation. The model parameterization is shown in Table 1.

#	Parameter	Symbol	Value	Comments
	Table 1. Bahrain: Model Parameterization			
1	Number of banks	B	20	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.
2	Base utility for cash	α_{CASH}	1.5	Represents the utility that non-bank 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.
3	Price sensitivity	β	100	Captures non-bank agents' willingness to alter their money holding composition in response to changes in interest rates on the different forms of money (and across banks). Together with the parameter B, it is used to let the model match the target deposit-policy rate spread and target cash ratio.
4	Velocity of money	γ	1.05	Informed by recent historical average (2013-22) for annual nominal GDP-to-M3 ratios (M3 adds government deposit balances to M2, in Bahrain).
5	Reserve requirement	λ	0.05	As per current setting of the Central Bank of Bahrain.
6	Reserve borrowing rate	i^{RB}	0.03	Recent historical average reference value.
7	Reserve remuneration rates for required and excess reserves	$[i^{RRH}, i^{ERH}]$	[0, 0.01]	Required reserves are not remunerated as per current central bank policy. Rate on excess reserves set in an empirically consistent manner with the assumed 3% reserve borrowing rate.

Notes: The model has been calibrated and estimated to match the observed/target deposit-policy rate spread and implied monetary policy pass-through to bank deposit rates at about 0.6; and to match an observed/target cash ratio of 4 percent. For more information about the calibration and estimation scheme for the model, see GL (2023).

9.   Competition in Bahrain's banking system is judged to be moderate-high. Bahrain is a highly banked economy that serves as a regional financial hub with a banking assets-to-GDP ratio above 600 percent. The banking system is comprised of 75 banks including conventional and Islamic banks as well as retail and wholesale banks. Three (five, ten) banks constitute a cumulative banking system total asset share of just beyond 50 (75, 95) percent. Deposit-policy rate spreads and profitability are low compared to peers (Figure 3). These factors hint at an above level of competition in the banking system.

10.   The share of cash in total money is low and declining, while the population's sensitivity to interest rate changes is low. Cash ratios gradually trended down since 2016, from close to 5.5 percent then to about 4 percent by mid-2022 (measured as currency in circulation over M3, the latter equaling M2 plus sovereign deposit holdings, in Bahrain). Notwithstanding the decline

in cash ratios, cash holdings have been relatively stable against changes in deposit interest rates and empirical monetary policy pass-through estimates are relatively low at 0.57, suggesting that interest rate sensitivity is low.[7]

11.   Banks' profitability is relatively low, while banks are reasonably well capitalized. RoA is low in comparison to peers (1.2 percent system weighted average in 2022, the lowest within the group of six countries in Figure 3) with most banks' RoA in a 0-3 percent range in 2022. As mentioned, this could be a result of intense competition in the market. Despite the weak RoA, the banking system's risk-weighted capital ratio trended up after the pandemic period to levels close to 20 percent. In comparison to regional peers, it ranks favorably, with only two of the five chosen peer countries in Figure 3 having somewhat higher capital ratios in 2022.

12.   Several counterfactual scenarios are considered. The baseline scenario serves as a pre-CBDC benchmark. In addition, six counterfactual scenarios are simulated which can be grouped across two dimensions.[8] The first dimension concerns the population's underlying preference for holding a CBDC, the "base utility", for which two cases are considered: setting it to either that of cash (referred to as "high base utility" in the following) or that of deposits ("low base utility"). The second dimension concerns CBDC remuneration. Three reference values are considered: setting it to zero (hereafter referred to as "unremunerated"), to the reserve remuneration rate for banks' excess reserves (ERR) [9], and to the policy rate (PR). The latter is considered an upper bound assumption. It implies CBDC remuneration above that of bank deposits and is a scenario that we provide only for information but do not discuss in detail. The results of the simulations pertaining to the six scenarios, relative to the pre-CBDC benchmark, are shown in Table 2. Figure 4 visualizes the results for a fuller grid of CBDC interest rates from zero to the policy rate, with which the tabular results are consistent.

13.   The results are subject to various sources of uncertainty. These include uncertainty stemming from estimated parameters and behavioral assumptions. Some additional caveats apply to the assessment, including that banks' lending behavior is static and exogenous in the model. The analysis is nonetheless judged to be informative, as in particular the lending spreads (to the banks' cost of funding) are endogenously determined, in a model with a full system perspective and integrated stock-flow consistent balance sheets.

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[7] While the model does not explicitly account for the role of the government or the oil sector in Bahrain's economy, these can be seen as implicitly reflected in the model's calibration, for example through the low monetary policy transmission and interest rate sensitivity of deposits.

[8] All the counterfactuals assume that CBDC competes with both cash and deposits which is referred to in the original paper as a "nesting off" assumption. "Nesting" denotes the grouping of money in two categories ("nests") in the model: the commercial bank deposit money (nest) and the central bank money (nest). The latter comprises cash, and CBDC once introduced. See Figure 2 and Section 3 in GL (2023).

[9] The rationale for choosing the bank reserve remuneration rate is that this is the rate at which the Central Bank remunerates banks for holding central bank money, so it can be argued that it is "fair" that non-bank holders of central bank money are remunerated at the same rate.

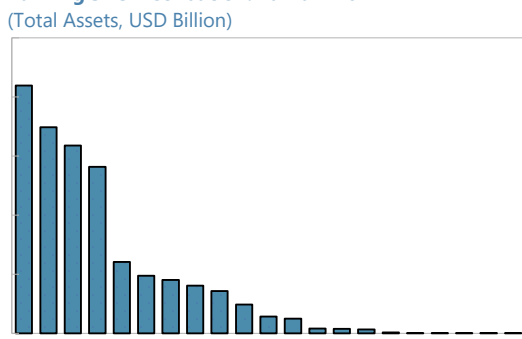## Figure 3. Bahrain: Banking System Structure—Selected Indicators

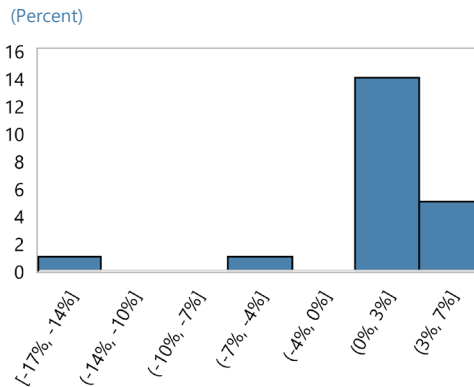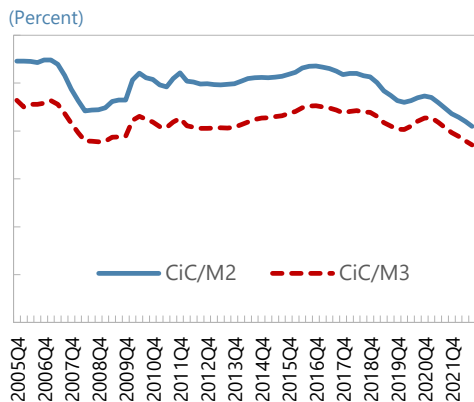**Regulatory Capital / Risk Weighted Assets: GCC**
(Percent)

Return on Assets: GCC
(Percent)

Legend: ■ 2016 ▨ 2017 ▨ 2018 ■ 2019 ▨ 2020 ■ 2021 ▨ 2022
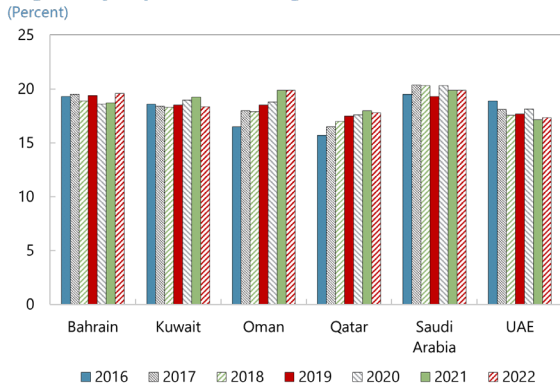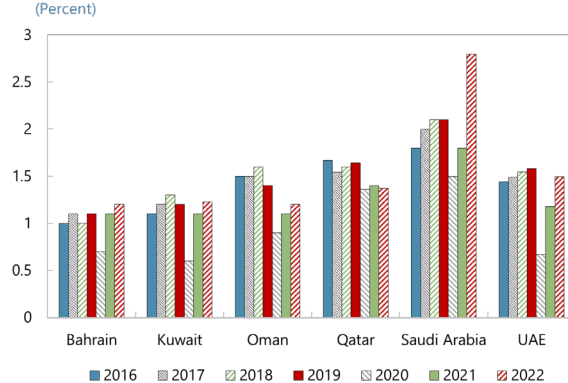
Banking Size Distribution: Bahrain 2021
(Total Assets, USD Billion)

Return on Assets across Bahrain Banks 2021
(Percent)

Cash Ratios: Bahrain
(Percent)

CiC/M2 ---- CiC/M3

Deposit - Policy Rate Spread and ROA
(Percent)
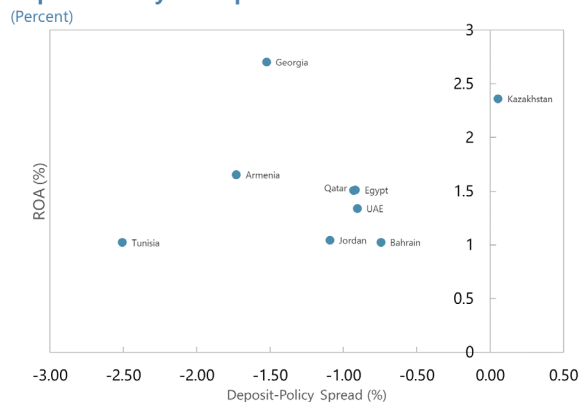
Notes: The velocity of money is defined as nominal GDP flows over the stock of M3. The quarterly measure take quarterly nominal GDP, while the annual measure takes a 4-quarter moving sum thereof in the numerator of the ratio. CiC in the cash ratio chart abbreviates currency in circulation.

Sources: World Economic Outlook, Haver Analytics, Fitch, and IMF staff estimates.

Results

14.   CBDC take-up primarily depends on its perceived utility to the population. Compared to a baseline share of cash in money of 4 percent, demand for a low base utility CBDC is expected to be limited at 0.5 percent of money if unremunerated and about 2 percent if remunerated at the ERR. In contrast, a high base utility CBDC could yield a share of money that is comparable to cash at 4 percent, if unremunerated, and as much as 9 percent, when remunerated at the ERR.

15.   At higher levels of take-up, a CBDC increasingly competes with deposits. The introduction of a CBDC initially crowds out both cash and bank deposits. However, given the already limited share of cash in total money, higher shares of CBDC in total money come at the expense of deposits. As such, deposit outflows are marginal for an unremunerated low base utility CBDC, reaching up to 2 percent in the remunerated case. However, a high base utility CBDC could drain about 3 percent of deposits if unremunerated and as much as 8 percent if remunerated at the ERR.

16.   Banks will have to raise their deposit rates to compete with a CBDC and more so if it were to be remunerated.[10] Low interest rate sensitivity in Bahrain means that increases in deposit rates would need to be significant to counteract deposit outflows, though the relatively high level of competition in the system and initially low deposit-policy spread limits the scope for further compression. Spreads decline by about 10 basis points (8 percent of the baseline deposit-policy rate spread of 1.3 p.p. in relative terms) in the case of an unremunerated CBDC, and by 15-20 basis points (12-15 percent of the baseline spread in relative terms) for a remunerated CBDC, depending on the base utility.

17.   Banks could incur higher deposit interest expenses, despite the decline in the volume of deposits. The change in bank interest expense reflects the combined impact of the rise in deposit rates (price effect) and the decline in deposit balances (volume effect). In the case of Bahrain, the price effect dominates the volume effect in all of the main scenarios, in part due to the low interest rate sensitivity.[11] Only under the upper bound scenarios of remuneration at the policy rate does the volume effect dominate the price effect, leading to declining deposit interest expenses.

18.   Banks would tap central bank reserves to replace deposit liabilities, thereby incurring additional interest expenses.[12] Demand for central bank reserves and the interest expense paid by

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[10] For example, banks may attempt to counteract the deposit outflows by raising their term deposit rates, to thereby incentivize sight deposit holders to migrate to term deposits instead of migrating to CBDC. Such reaction would increase the cost of deposits but imply yet less of a higher expense than outright borrowing of central bank reserves. Depositors may, however, not be incentivized so as to completely abstain from moving into CBDC in this manner, because term deposits are less liquid and hence serve the transaction function of money to a lesser extent.

[11] The CBDC counterfactual analysis for the US and the euro area in GL (2023) suggests that the deposit volume effects there dominate the deposit price effect, for absolute deposit expenses to fall.

[12] The mechanism by which banks replace deposit liabilities with central bank reserves depends on the central bank's liquidity management framework and has implications for bank profitability. For a financial system in a liquidity surplus position (floor system), as Bahrain's system is currently, banks would draw on their excess reserves held at the

(continued)

banks on them are commensurate to the size of deposit outflows. Consequently, incurred interest is relatively limited in the case of a low base utility CBDC at 1 and 4 percent of baseline net income in the case of an unremunerated and remunerated CBDC, respectively. However, for a high base utility CBDC, interest on reserve borrowing could be sizable at 7 percent of net income in the unremunerated scenario and even higher if the CBDC were to be remunerated reaching 20 percent of baseline net income.

19.   The drag on profitability resulting from higher interest expenses can be notable, particularly in the case of a remunerated CBDC.[13] For an unremunerated CBDC, banks' net income declines by 10-12 percent depending on the base utility level. For a remunerated CBDC, the drag on net income could be more pronounced, reaching 21 percent for a high base utility CBDC. Expressed in RoA terms, the impact on profitability ranges from -11 to -15 basis points in the unremunerated scenario but rises to -25 basis points with remuneration and high base utility. The latter maybe material compared to prevailing RoA levels in Bahrain, especially for banks whose RoA rests at the lower end of the bank distribution.

20.   Central bank's net income grows due to higher interest income from reserve lending, which would be offset by any interest paid on CBDC balances. As banks' demand for reserve borrowing increases, the central bank correspondingly earns more interest income. However, in the case of a remunerated CBDC, it would also pay interest on the outstanding CBDC balances to the public. At higher levels of CBDC remuneration, the associated interest expense for the central bank could at some point dominate its higher income earned from its reserve lending. This nonlinearity is visible in Table 2 as well as in Figure 4 for the full range of CBDC interest. The central bank's net seigniorage first increases with positive but low CBDC interest until the CBDC remuneration rate surpasses about half the level of the policy rate. At a CBDC interest rate level beyond about three quarters of the policy rate, its net income is estimated to fall below the baseline benchmark scenario.

21.   CBDC introduction strengthens monetary policy pass-through and more so if it were remunerated. The closer alignment of deposit rates with policy rates and the increased role of

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central bank, and hence forgo the interest earned on these reserves at the ERR. In a financial system without excess liquidity (corridor system), banks would borrow ("pull") reserves from the central bank and pay interest on the borrowed reserves at the PR. Alternatively, the central bank could choose to supply ("push") the reserves to the system, through open market operations or quantitative easing, which could take place at no cost to banks. The model adopts the most conservative assumption where banks borrow the reserves from the central bank at the PR and hence, model estimates for bank's interest expense paid on reserves can be interpreted as an upper bound.

[13] It is worth noting that the model does not assume that banks pass on the additional costs to borrowers through higher lending rates; while the deposit-lending rate spread does, however, already drop endogenously. A dampening effect on nominal credit demand may be expected if banks were to raise lending rates in principle. However, the pass-through to nominal and real credit and economic activity is not *a prior* clear. Consider, for example, that banks would thereby aim to earn additional interest income, which would raise their profits to an extent, and in turn dividend payouts to the private sector. This would increase the debt service ability of the private sector and hence lessen the drop in credit demand. Moreover, estimates for the pass-through from lending rates to investment and consumption are found to be small. See, for example: JPM, FRB, BoE, and RBA. Against this background, monetary policy makers may find the argument to strengthen another component—albeit at a different point in the "pass-through chain"—through the introduction of an (interest-bearing) CBDC appealing.

central bank reserves in bank funding following the introduction of a CBDC enhances the effectiveness of monetary policy. The pass-through strengthens from 0.57 in the baseline to 0.6 in the case of an unremunerated CBDC and rises to 0.62-0.63 in the case of a remunerated CBDC, depending on base utility assumptions. In the scenario of remuneration at the policy rate, the pass-though could rise to as high as 0.7 for a high base utility CBDC.

Discussions and Conclusions

22.   Ensuring robust CBDC adoption while minimizing risks to financial stability is a balancing act. While too little CBDC adoption may limit the gains from its introduction and fail to effectively achieve its initial objectives, too much adoption early on may lead to sizable deposit outflows from banks with negative implications for bank profitability and financial stability. The counterfactual scenarios presented in this paper suggest that a CBDC share of money comparable to cash may strike a reasonable balance.

23.   A careful design critically determines CBDC take-up. The counterfactual results highlight that the population's perception of a CBDC's utility is a key factor for adoption. As such, it is important to maximize this perceived utility to ensure robust demand. For that, design choices and the legal framework[14] are critical to ensure a seamless user experience, operational resilience and a balance between anonymity, cybersecurity and AML/CFT compliance requirements. Caps on CBDC holdings or flows and end-of-day sweeping of excess CBDC balances can help contain bank deposit outflows and financial sector spillovers if CBDC demand proved too strong.

24.   The Bahraini banking system is assessed to be reasonably able to withstand the introduction of a CBDC. Bahrain's banking system-wide RoA is found to remain positive upon CBDC introduction which implies that banks' capital ratios would not be at risk of downward trending; even if a weaker tail of banks (in terms of RoA) may be at some risk of becoming strained.[15] The latter are to be actively monitored upon CBDC introduction to mitigate potential risks.

25.   Starting with an unremunerated CBDC is prudent, but remuneration may not be ruled out for a later stage. The significant impact on bank deposits and profitability found in the case of a remunerated high base utility CBDC suggests that caution is warranted before considering CBDC remuneration to avoid disrupting the financial system in unforeseen ways. However, remuneration may not be entirely ruled out in the future given its ability to further enhance monetary policy pass-

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[14] Bossu, W., et al. 2020. "Legal Aspects of Central Bank Digital Currency: Central Bank and Monetary Law Considerations." IMF Working Paper No. 20/254, International Monetary Fund, Washington DC.

[15] As long as net income and hence RoA is positive, it contributes positively to capital ratios. Negative net income, and hence negative RoA would contribute negatively. The counterfactual results we obtain for Bahrain all imply that RoA remains positive. Asset growth or risk-weighted asset growth effects for the denominator of the bank capital ratios are not considered in the model analysis.

through.[16] As such, it would be important to ensure the CBDC's technological design allows for it to be interest-bearing if that was deemed useful at some later stage.

26.   More in-depth quantitative analyses are warranted. Further investigation is needed to deepen the understanding of the impact channels. This can help inform the calibration of design choices and parameters such as caps on CBDC holdings or flows or potential CBDC remuneration schemes. Outputs from models of the kind used in this note can also be used as input to bank stress testing exercises. The analysis can be extended to capture other specific features of the Bahraini banking system, such the presence of a large Islamic banking segment, which typically relies more on unremunerated deposit funding, which will likely be more exposed to CBDC-induced competition. Bahrain's status as a regional financial hub also implies an open and regionally integrated financial system as well as a significant share of foreign currency deposits, which would ideally be captured in a model.

27.   A pilot would be an appropriate testing ground. Theoretical models cannot substitute for the need to test the CBDC in a real environment and Bahrain's regulatory sandbox provides a suitable venue to do so. A pilot should aim to ensure operational resilience to limit reputational risks arising from any potential disruption or outage that could undermine adoption later on. It would also inform the appropriateness of the CBDC's design choices and calibration by providing additional inputs for analysis and allowing for modifications ahead of a wider launch.

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[16] While many central banks communicate their justified intention to start with unremunerated CBDCs (zero interest), many of them communicate their interest in conducting research into the merits and risks of considering remunerated CBDCs. For example, the ECB notes that if a CBDC "is considered for improving the transmission of monetary policy, the digital euro should be remunerated at interest rates that the central bank can modify over time" (ECB 2020, p. 14). The Bank of England suggests that "if new forms of digital money offered interest rates, [...] they could potentially enhance the transmission of monetary policy" (BoE 2021, p. 13). The Bank of Canada notes: "Central banks could increase the attractiveness of central bank money as a settlement vehicle between individuals by enabling interest payments on CBDC holdings. For this reason, if central banks decide to issue a CBDC, its design should allow it to be interest-bearing (even if the interest rate is set at zero to begin with)" (BoC 2020, p. 3). The US Board of Governors notes: "The interactions between CBDC and monetary policy implementation would be more pronounced and more complicated if the CBDC were interest-bearing at levels that are comparable to rates of return on other safe assets" (BoG 2022, p. 23). Recent BIS survey reports published in 2022 suggest that about 45 percent of African countries in-scope of the survey consider the CBDC design choice regarding interest still open, and another 20 percent plan to go for an interest-bearing design, i.e., 65 percent of African countries consider interest outright or examine the possibility; in addition, about 40-45 percent of emerging markets consider the question open, too. The analysis presented in this chapter remains neutral about the remuneration aspect.

Table 2. Bahrain: CBDC Counterfactual Simulation Results						
Base utility of CBDC →		CBDC's Base Utility = Deposit Money's Base Utility			CBDC's Base Utility = Cash's Base Utility		
CBDC Interest →		0%	Reserve rem. rate	Policy rate	0%	Reserve rem. rate	Policy rate
Money shares	**Deposits** (base = 96%)	95.5%	94.5%	83%	92.5%	88%	56%
	Cash (base = 4%)	3.5%	3.5%	3%	3.5%	3%	2%
	CBDC (base = 0%)	0.5%	2.0%	14%	4%	9%	42%
Deposit-policy rate spread (baseline = 1.3 p.p.)		1.2 p.p.	1.15 p.p.	1.12 p.p.	1.2 p.p.	1.1 p.p.	1 p.p.
Deposits (Δ to baseline)		-0.1 bn -0%	-0.25 bn -2%	-2 bn -13%	-0.5 bn -3%	-1.2 bn -8%	-6.2 bn -42%
Reserve borrowing (Δ to baseline)		+0.05 bn	+0.2 bn	+1.8 bn	+0.4 bn	+1.1 bn	+5.8 bn
Banks' deposit interest expense (Δ to baseline p.a.)		+16 mn +7%	+18 mn +7%	-7.6 mn -3%	+7.8 mn +3%	+5.4 mn +2%	-82.3 mn -34%
Banks' net res. borrowing expense = CB's net res. lending income (Δ to baseline p.a.)		1.5 mn +3%	7 mn +15%	55 mn +124%	13 mn +30%	34 mn +76%	173 mn +393%
Banks' net income (Δ to baseline p.a.)		-17.4 mn -10%	-24 mn -13%	-47 mn -26%	-21 mn -12%	-39 mn -21%	-91 mn -50%
Banks' Return on Assets (RoA, annual) (Δ to baseline p.a. in basis points)		-11 bps	-16 bps	-30 bps	-15 bps	-25 bps	-60 bps
CB's CBDC interest expense (Δ to baseline p.a.)		-	+3.5 mn	+65 mn	-	+14 mn	+195 mn
Central bank net seigniorage (Δ to baseline p.a.)		+1.5 mn +3%	+3.1 mn +7%	-10 mn -23%	+13 mn +30%	+20 mn +45%	-21 mn -50%
Monetary policy pass-through to bank deposit rates (baseline = 0.57)		0.6	0.62	0.63	0.6	0.63	0.7

Notes: All results are expressed as deviation from current (baseline); except for the money shares. "p.a." abbreviates per annum. Million and billion amounts are in BHD. The third and sixth column are considered an upper bound for illustrative purposes.

Figure 4. Bahrain: CBDC Counterfactual Simulation Results—Upper and Lower Bound Scenarios (CBDC Interest from Zero to Policy Rate)
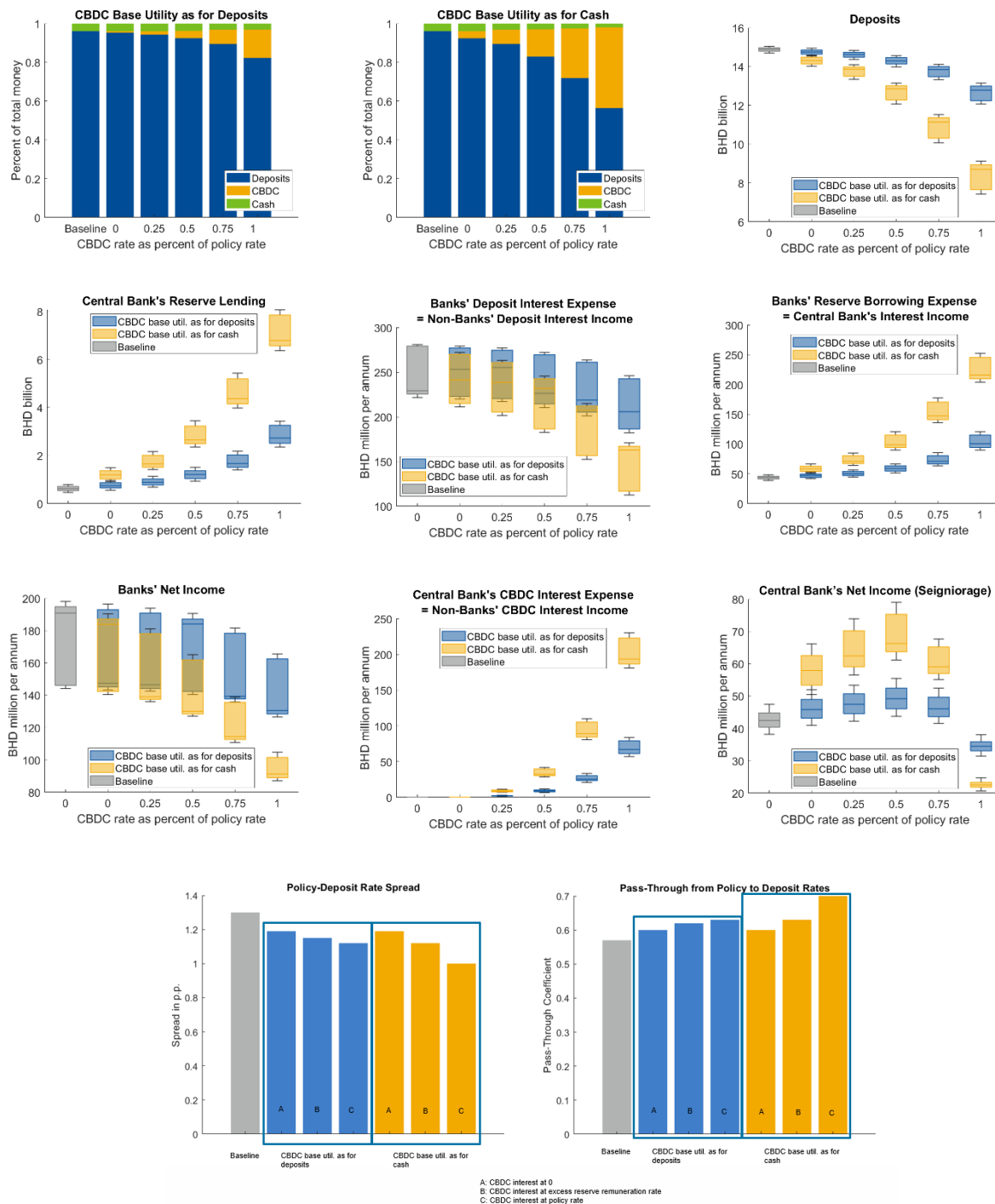
Notes: The chart panel summarizes the results from the CBDC counterfactual simulation results for Bahrain. "Deposit-like" means that CBDC's base utility equals that of deposits. "Cash-like" means that CBDC's base utility equals that of cash (central bank money). Banks' reserve holdings and reserve holding-related interest income flows are omitted from the chart collection because they are quantitatively small.

Source: Monetary and macro-financial statistics from CBB data warehouse and IMF calculations based on the model of GL (2023).