مصرف الإمارات العربية المتحدة المركزي
CENTRAL BANK OF THE U.A.E.

Digital Dirham - Selected Issues and Policy Considerations*

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الدرهم الرقمي: القضايا المختارة والاعتبارات السياسية[1]

الخلاصة

يسعى مصرف الإمارات العربية المتحدة المركزي ("المصرف المركزي") لمواكبة الاحتياجات المتغيرة للاقتصاد الرقمي، ولضمان مواكبة أموال المصرف المركزي لمتطلبات العصر الرقمي. ولتحقيق هذا الهدف، سيُطلق المصرف المركزي قريباً عملته الرقمية "الدرهم الرقمي"، بجميع أشكاله (للجملة وللتجزئة). أنشأ المصرف المركزي منصة إصدار مصممة خصيصاً لهذا الغرض، وساهم في تطوير منتج الحد الأدنى القابل للتطبيق في منصة الجسر لاستخدام الدرهم الرقمي محلياً وعبر الحدود. ومن الممكن أن تؤثر التغيّرات في طرق الدفع، والأشكال الجديدة من الأصول الافتراضية، وتراجع استخدام النقد، على الدور الذي تمارسه المصارف المركزية مستقبلاً وعلى قدرتها على تحقيق أهدافها من السياسة النقدية، مثل ضمان كفاءة نظم الدفع وتطبيق سعر الفائدة بفعالية. ويمكن للعملات الرقمية للمصارف المركزية معالجة مثل هذه الحالات التي تحمل في طياتها مخاوف، ويتم ذلك من خلال توفير شكل جديد من الأموال الرقمية القادرة على تلبية المتطلبات المتزايدة للاقتصاد الرقمي على نحو أفضل، مع المحافظة على ثقة الجمهور في العملة الوطنية. سيتم دمج الدرهم الرقمي بالكامل في نظام الدفع ليكون مخزن للقيمة مع تمتعه بسمة العملة القانونية، مما يتيح إجراء التسويات الفورية، والتمكّن من استخدامه على نطاق واسع، كشكل آمن وموثوق ومريح من أشكال الأموال التقليدية للمصرف المركزي.

يحمل الدرهم الرقمي في طياته مزايا كثيرة، ومن الممكن أن يؤدي لتعزيز كفاءة نظام المدفوعات، وزيادة فعالية السياسة النقدية، وتنفيذ طلبات جديدة للاقتصاد الرقمي. يؤدي الدرهم الرقمي الذي يمكن لشريحة واسعة الوصول إليه، لزيادة إمكانية استخدام الخدمات المالية من قبل الأفراد الذين لا يتعاملون مع البنوك أو من قبلٍ أولئك الذين لا يمكنهم الحصول على الخدمات المصرفية، مما يضمنُ توزيع المنافع التي تحققها الرقمنة بعدالة، وسيُعتبر الدرهم الرقمي أيضاً وسيلة أساسية لتدفقات الحوالات. بالإضافة لذلك، سيؤدي الدرهم الرقمي إلى تعزيز مكانة دولة الإمارات العربية المتحدة كمركز مالي إقليمي، من خلال توفير وسيلة دفع مبتكرة تزامناً مع التطوّرات التي تشهدها التقنيات الرقمية.

ستؤدي مبادئ السياسة الرئيسية وميزات التصميم إلى تخفيف المخاطر المحتملة، بما في ذلك المحافظة على الوساطة المالية القائمة على البنوك. وبشكل مشابه لأي عملة رقمية أخرى لبنك مركزي، يمكن أن يحمل الدرهم الرقمي في طياته مخاطر على الاستقرار المالي والنقدي، إلى جانب تحديات تتعلق بالخصوصية والأمن السيبراني والنشاط غير المشروع. كما ستتوفر سمات تصميم رئيسية مختلفة، بما في ذلك نموذج توزيع من مستويين من خلال الوساطة (بالتعاون مع المؤسسات المالية المرخصة) ومن خلال إمكانية الوصول القائمة على المحفظة. بالإضافة لذلك، ستضمن القيود الموضوعة بشكل ملائم وعدم دفع مكافآت - من منظور السياسة - استخدام الدرهم الرقمي في المقام الأول كوسيلة للدفع (مع مواصلة الاحتفاظ بالجزء الأكبر من الودائع والمدخرات في البنوك والمؤسسات المالية الأخرى). وسيساعد استخدام الدرهم الرقمي بصفة "وهمية" على حماية الخصوصية، ولكن ذلك يتضمن استخدام الهوية الرقمية/ وتطبيق بروتوكولات اعرف عميلك، وإمكانية تعقّب المدفوعات، لردع إساءة الاستخدام لأغراض غير مشروعة.

* تم إعداد ورقة العمل هذه تحت إشراف مساعدي المحافظ، سعادة إبراهيم عبيد إبراهيم الزعابي وسعادة سيف حميد حمد الظاهري. وقام أندرياس أ. جوبست (دائرة السياسة النقدية) وبوني تيمونين (دائرة الاستقرار المالي) بقيادة فريق إعداد ورقة العمل، وبمشاركات من أوغوزان سيبني، مايكل كريد، ألكساندر كاريف، لقمان قاسم، بيكا لامازوشفيلي، ويلي ليم، ديني ميمك، وليد عيد عبدالرحمن سمارة، أندرو تيرنر. تم الحصول على التحليل الاقتصادي والنواحي القانونية من تحليل سابق لدراسة الجدوى تم إعدادها من قبل شركة "R3"، كيرني وكليفورد تشانس مع العديد من موظفي مصرف الإمارات العربية المتحدة المركزي، والذين ساعدوا في تطوير الجوانب التشغيلية والرقابية وجوانب الحوكمة، بالإضافة للاعتبارات الخاصة بالسياسة في مشروع الدرهم الرقمي، بما فيهم سالم الحرمي، حامد عريدات، أولديس سيربس، فرانسيسكو جريجولي، بول كيروز، شوبوي لي، علي فكري، جيمس أوبرين، حفيظ أوبريك، بابو سانثانام، وسيم سلامة. وكان للملاحظات والاقتراحات المُقدّمة من قبل هانز كيلر، كونور كيتل، جيرك كوسزا، باتريك سلوفيك أهمية بالغة في إعداد ورقة العمل هذه. البريد الإلكتروني للمسؤول عن إعداد ورقة العمل: andreas.jobst@cbuae.gov.ae.

Abstract

The Central Bank of the UAE (CBUAE) will soon be launching the UAE's central bank digital currency (CBDC) – the "Digital Dirham" – in all formats (wholesale and retail) in response to the evolving needs of a digital economy. The CBUAE has created a custom-built issuance platform and contributed to the development of the mBridge minimum viable product (MVP) for the domestic and cross-border use of the Digital Dirham. Changes in payment methods, new forms of virtual assets, and the declining usage of cash could affect the future role of central banks and their ability to achieve their policy objectives, such as ensuring efficient payment systems and effective interest rate transmission. CBDCs can address such concerns by offering a new form of digital money that can better cater to the requirements of an increasingly digital economy while upholding public confidence in the national currency. The Digital Dirham will be fully integrated in the payment system with legal tender status, enabling instant settlements and widespread accessibility as a secure, trusted and convenient form of traditional central bank money.

The Digital Dirham offers significant benefits. It can enhance payment system efficiency, increase monetary policy effectiveness, and enable new digital economy applications. A widely accessible Digital Dirham also expands access to financial services for unbanked or underbanked individuals, ensuring equitable distribution of digitalisation benefits and serving as key channel for remittance flows. In addition, the Digital Dirham can boost the UAE's position as a regional financial centre by offering innovative payment services as digital technologies progress.

Key policy principles and design features will mitigate potential risks, including by preserving bank-based financial intermediation. Like any other CBDC, the Digital Dirham could present risks to financial and monetary stability as well as challenges related to privacy, cybersecurity, and illicit activity. Various key design features, including an intermediated two-tier distribution model (in collaboration with licensed financial institutions) and wallet-based access, will be incorporated. Appropriate limits and non-remuneration will ensure - from a policy perspective - that the Digital Dirham is used primarily as a means of payment (while the bulk of deposits and savings continues to be held at banks and other financial institutions). "Pseudonymity" will help safeguard privacy but include digital identity/KYC protocols and payment traceability to deter its misuse for illicit purposes.

In 2023, the CBUAE initiated the first phase of Digital Dirham implementation by establishing a robust and comprehensive legal and policy framework to support the issuance of CBDC as legal tender. The CBUAE has already carried out a real-value retail pilot to evaluate the future design, technology and advantages of the Digital Dirham and developed four digital economy use cases to assess the feasibility and effectiveness of the Digital Dirham as a novel payment method, which – in its planned configuration – can open up new business models and spur financial innovation through flexible interoperability, accessibility, and programmability. The CBUAE is now able to issue and distribute the Digital Dirham to LFIs having built a customised issuance platform that utilises distributed ledger technology (DLT).

* This working paper was prepared under the auspices of Assistant Governors H.E. Ebrahim Obaid Ebrahim Al-Zaabi and Saif Humaid Hamad Aldhaheri. The drafting team was led by Andreas A. Jobst (Monetary Policy Department) and Jouni Timonen (Financial Stability Department) with contributions from Oguzhan Cepni, Michael Creed, Alexander Karpf, Lokmen Kassim, Beka Lamazoshvili, Willy Lim, Deni Memic, Waleed Eid Abdel Rhman Samarah, and Andrew Turner. The economic analysis and legal considerations were informed by an earlier feasibility analysis, which was completed by R3, Kearney and Clifford Chance as well as several CBUAE staff members that helped develop the operational, regulatory, and governance aspects along with policy considerations of the Digital Dirham project, including Salem Alharmi, Hamed Areidat, Uldis Cerps, Francesco Grigoli, Paul Kayrouz, Shu Pui Li, Ali Mukri, James O'Brien, Hafid Oubrik, Babu Santhanam, and Wassim Slama. Helpful comments and suggestions from Hannes Keller, Connor Kettle, Jarek Kowcza, and Patrick Slovik are gratefully acknowledged. Corresponding author: andreas.jobst@cbuae.gov.ae

The Digital Dirham will be introduced in a phased approach for retail, wholesale, and cross-border transactions. In early 2024, the CBUAE completed its first issuance of the Digital Dirham in the context of a cross-border transaction as part of Project mBridge. Project mBridge is the world's first operational multi-CBDC platform, facilitating efficient, cost-effective, and instant cross-border payment and settlement in central bank money. In the coming years, the CBUAE – in partnership with relevant government entities and industry stakeholders – will advance preparations for the full launch of both the retail and wholesale versions of the Digital Dirham using a cautious, flexible and collaborative approach. A graduated and controlled rollout of the Digital Dirham aligns with CBDC initiatives in other countries and allows for ongoing monitoring of global CBDC developments, enabling the identification of emerging insights and lessons learned.

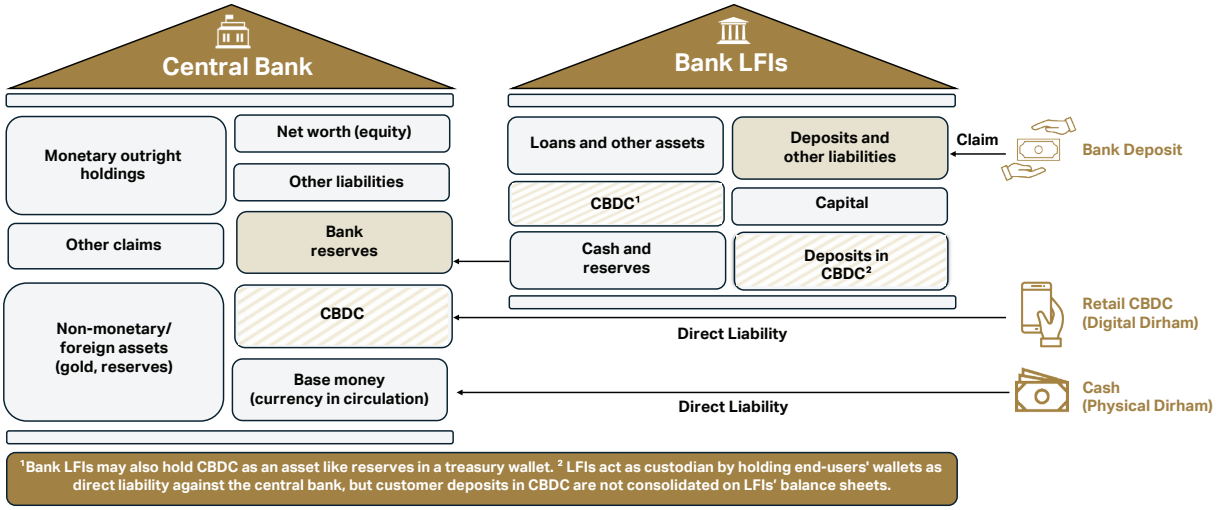
This paper examines the key policy considerations and design aspects that have shaped the development of the Digital Dirham. It also provides an overview of how the CBUAE considered relevant costs and benefits and implemented necessary measures to mitigate potential risks. In addition, the paper explains the CBUAE's policy principles that have guided the design and governance of the Digital Dirham. It concludes with an update on the current progress in creating the operational model and provides a brief outlook on the next steps needed before the official launch of the Digital Dirham.

Keywords: CBDC, digital currency, money, Dirham
JEL classification: G21, E41, E42, E44, E51, E52, E58

1. Introduction

With the world increasingly moving towards further digitalisation, central banks need to evaluate the implications of technological advancements affecting the financial system,[1] including future-proofing access to central bank money, safeguarding efficient payment systems and ensuring effective monetary policy transmission.[2] If payments are solely managed by the private sector, the circulation of physical cash – as the only form of money issued by central bank to the public (outside the banking sector) – will decrease significantly, marginalising the relevance of reserves held at the central bank for settlement purposes (Bindseil and Senner, 2024a; McLellan, 2022).[3] As a result, the reduction in the size of central bank balance sheets and a decrease in bank deposits could weaken monetary and financial stability.

Figure 1. CBDC – A New Form of Digital Money



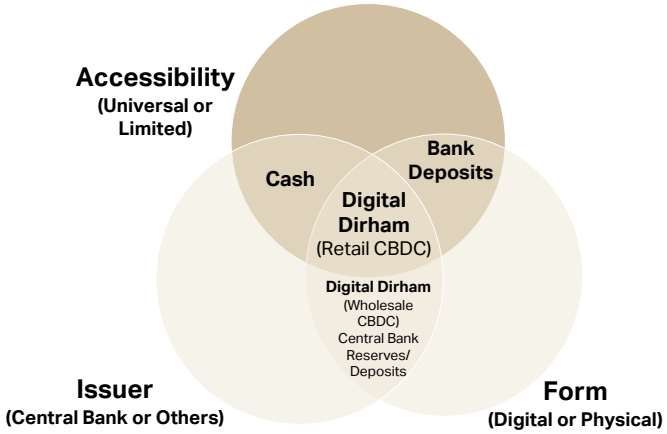
Source: authors.

Many central banks are exploring the possibility of implementing a central bank digital currency (CBDC) as a complement to bank-created "private money".[4,5] CBDCs help central banks align the evolution of payment systems with their policy goals by meeting the accessibility demands of an increasingly digitalised economy while preserving public trust in money. They are a new (digital) form of money issued by central bank as a direct liability, like cash and central bank reserves (Figure 1). Unlike private forms of money, such as bank deposits, CBDCs are created and supported by central bank and governments, guaranteeing their stability and legal tender status (IMF, 2023b). However, unlike cash, CBDCs offer new functionalities and features that enable innovative and programmable payments, instant settlement, and greater financial service availability. The goal of CBDCs is to improve payment system effectiveness and reinforce monetary policy execution. A properly designed CBDC can balance safeguarding user privacy and data while preventing financial crime and ensuring law enforcement.

Over the last two years, the CBUAE has been working on the implementation of the UAE's own CBDC – the "Digital Dirham" (CBUAE, 2023a).[6] The CBUAE initiated the development of a CBDC in early 2023 as part of its *Financial Infrastructure Transformation* (FIT) programme (CBUAE, 2023b). This initiative is part of a long-term strategy to modernise and adjust current payment systems and monetary framework to meet the needs of a digital economy and enhance financial inclusion. Following amendments to Federal Law No. 14 of 2018 concerning the *central bank and the Regulation of Financial Institutions and Financial Activities* ("CBUAE Law") in 2023, the CBUAE can now issue Digital Dirham as legal tender, enabling instant settlements and widespread accessibility. It will be considered a liability of the CBUAE, alongside cash, central bank reserves, and CBUAE-issued financial instruments like Monetary Bills (M-Bills) and Islamic Certificates of Deposit. It will be fully interchangeable with cash and bank deposits at par value.

The CBUAE has designed the Digital Dirham as a universal payment instrument for retail, wholesale and cross-border use. CBDCs are generally categorised into three forms (Figure 2): (1) retail CBDCs (or rCBDC) for public use in secure and cost-effective retail payments; (2) wholesale CBDCs (or wCBDC) for financial institutions and corporations in interbank transfers and high-value payments; and (3) cross-border CBDCs (or xCBDC) for international trade settlements, financial transactions, government transfers, and remittances (World Bank, 2021). The CBUAE is currently working on developing all three versions of the Digital Dirham. However, this paper focuses mostly on rCBDC due to its advanced stage of development, with some key issues for wCBDC and xCBDC also discussed.

Figure 2. Classification of the Digital Dirham as Currency



Sources: BIS (2018) and authors.

The adoption of the Digital Dirham can improve payment system efficiency, enhance monetary policy transmission, and enable new digital economy applications (Annex 1). The Digital Dirham will simplify processes by reducing payment costs and enabling immediate settlement for retail, wholesale, and cross-border transactions. A widely accessible Digital Dirham could also expand access to financial services for unbanked or underbanked individuals, ensuring equitable distribution of digitalisation benefits and serving as a key channel for remittance flows. Moreover, the Digital Dirham can boost the UAE's position as a regional financial centre by offering more efficient payment services, domestically and cross-border, as digital commerce evolves. Additionally, it will support initiatives for privacy and combat illicit financial activities.

Figure 3. Key Benefits of the Digital Dirham

Source: authors.

The CBUAE has considered the necessary policy principles to mitigate any unintended consequences of introducing the Digital Dirham. The Digital Dirham – like any other CBDC – could present potential risks to financial and monetary stability as well as challenges related to privacy, cybersecurity, and illicit financing, which could outweigh its benefits.[7] Several key measures in its design, governance and implementation, together with an intermediated two-tier distribution model and wallet-based access, will help maintain financial and monetary stability, enhance financial inclusion, and prevent financial crime (Figure 3):

- ***Financial stability:*** The issuance of the Digital Dirham could disrupt credit creation if financial flows bypass commercial banks and consumers hold CBDCs instead of bank deposits. Also, in times of stress or economic uncertainty, more consumers may choose to convert their bank deposits into CBDCs, potentially leading to a systemic bank run. Design features and governance of the Digital Dirham should help prevent any negative effects on financial stability while safeguarding the banking sector's role as financial intermediaries. Appropriate limits and non-remuneration will ensure - from a policy perspective - the transactional use of the Digital Dirham (rather than promoting the Digital Dirham as a substitute for savings).

- ***Monetary policy:*** The introduction of a non-remunerated Digital Dirham will expand access to non-cash central bank money to the general public, which could impact monetary policy transmission channels if it influences saving and borrowing decisions. Thus, the design of the Digital Dirham must contribute to the stability of the national currency (i.e., through the longstanding US Dollar peg) and the continuity of the monetary framework, a current floor-system for policy interest rate setting as the main method for transmitting, the CBUAE's monetary policy stance. The Digital Dirham should be easily exchangeable and seen as having the same value as other forms of money issued by the CBUAE, such as cash and reserves, to ensure consistency of central bank money, regardless of its form.[8]

- ***Financial inclusion and accessibility:*** The Digital Dirham could inadvertently exclude individuals who lack access to digital infrastructure or the necessary technological literacy, thereby widening the gap between those who can participate in the digital economy and those who cannot. Therefore, the CBUAE will conduct a financial literacy campaign to educate the public on the Digital Dirham. A widely accessible and accepted Digital Dirham can offer financial services also to the unbanked and underbanked, including as a key channel for remittances of a large expatriate workforce.[9] The Digital Dirham should serve as a public good and reduce the cost of payments for consumers and businesses.[10] Additionally, it should incorporate features that encourage widespread usage, including supporting new use cases and new business models for both the end-user and intermediaries.

- ***Privacy and financial crime:*** The key challenge in designing CBDCs is finding the right balance between ensuring financial privacy akin to physical cash, and preventing illegal activities such as money laundering and terrorism financing. Excessive surveillance could lead to restrictive financial monitoring. The design of the Digital Dirham should protect user privacy and user data with strong safeguards; at the same time, the Digital Dirham must adhere to anti-money laundering/combating the financing of terrorism (AML/CFT) and know-your-customer (KYC) requirements to mitigate the risk of financial crime.[11] User data will be held with wallet providers, but no personal identifiable information (PII) will be stored on the ledger. Pseudonymity[12] of users and encryption will safeguard privacy. Digital identity/KYC protocols and payment traceability will facilitate suspicious transaction reporting in case of a reporting entity suspects a financial crime.

- ***Cybersecurity and operational risk:*** The Digital Dirham could face cyber-threats, potentially undermining trust in the UAE's financial system and the CBUAE. The level of risk will not only hinge on the effectiveness of cyber-security and cyber-resilience measures but also depend on privacy governance (see above), such as Digital Dirham's digital identity framework. The Digital Dirham must minimise cyber-security risks while ensuring adequate privacy protections.

2. Key Implementation Challenges

As part of the decision-making process on fundamental design aspects and policy choices, the CBUAE has completed a comprehensive analysis of potential implications of the Digital Dirham in the following areas: macroeconomic and financial stability, monetary policy, cyber-security, operational risk, and consumer protection.[13]

2.1. Macroeconomic and Financial Stability Implications

In general, the issuance of CBDCs has complex macro-financial implications (Table 1 and Annex 2). The impact of a CBDC on the financial system will evolve over time, depending on the pace and extent of its implementation during the transition phase and in the long run. The potential effects could differ during periods of financial stress compared to normal market conditions (Bank of England/HM Treasury, 2023). Given the novelty of CBDCs, uncertainties surrounding their adoption rates as well as the role of perceptions and expectations (e.g., regarding bank runs), make it difficult to assess their use and impact. Moreover, critical design and policy decisions can have substantial implications for the realisation of macro-financial effects. Therefore, a thorough evaluation of these decisions is essential to safeguard the stability of the financial system.

Bank disintermediation is the most common topic discussed in the literature, with the potential for CBDC-induced deposit outflows (negatively) affecting banks' profitability and business models (Bouis and others, 2024; Infante and others, 2022). Banks may initially use their liquidity buffers and excess reserves at the central bank to address any outflow of deposits, but there could be varying impacts on different banks. Regulatory liquidity ratios must be maintained, potentially limiting the use of high-quality liquid assets. To compensate, banks may raise deposit rates and turn to more expensive (and riskier) wholesale funding. These factors could impact banking sector profitability, leading to higher lending rates and potentially affecting lending volumes and economic activity.

The introduction of a CBDC could impact depositors' behaviour during times of stress, potentially leading to bank runs. With access to a CBDC, depositors have a quick, cost-free, and low-risk alternative to holding funds at banks. During times of stress, this could result in self-fulfilling shocks, including baseless rumours, leading to more frequent and pervasive bank runs (Caccia and others, 2024). The failure of Silicon Valley Bank and several other US regional banks during the spring of 2023 demonstrates how quickly bank runs can evolve in the digital age (BCBS, 2023). While the introduction of a CBDC could increase the likelihood of such outcomes, safeguards like holding limits could help mitigate these risks without constraining the transactional use of CBDC.

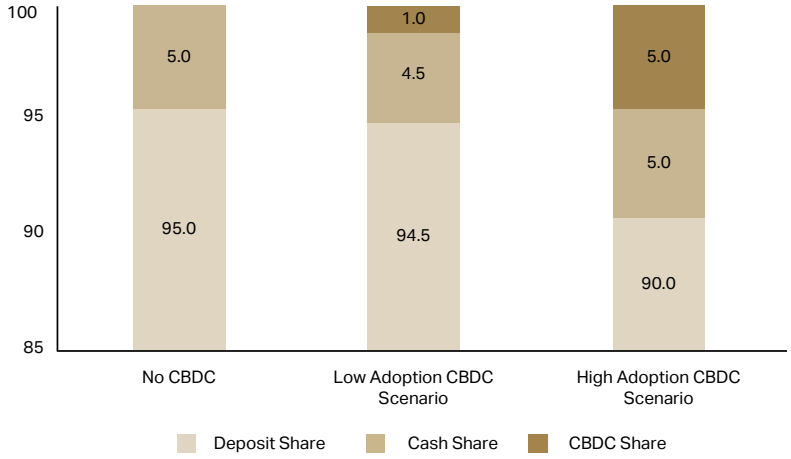
Table 1. Selected Key Macro-Financial Risks from CBDC Introduction

	Near Term (Transition Period)		Longer Term (Steady State)	
Normal Market Conditions	Disinter-mediation	• Less (more) deposit (wholesale) funding → higher bank funding costs • Higher lending rates and less lending → tighter financing conditions and adverse impacts on economic activity • Lower bank profitability → less dividends or lower (organic) capital growth → lower resilience	Deposit volatility	Possibly less available capital[1] for investment in productive long-term assets, which could lower overall productivity
			De-leveraging of the banking sector	Higher crisis resilience due to less risk-taking and reduced vulnerability to asset price shocks
Stress Periods	Flight to safety and deposit run(s) could trigger a credit crunch through the lending channel and significantly raise vulnerabilities		Lower opportunity cost of hoarding risk-free central bank money (if no holding limits)	Higher probability of bank runs and financial crises

Source: authors. *Note:* 1/ wholesale funding could also be riskier (short term, more concentrated in size and sector) and/or lead to riskier lending/investment decisions to preserve profit margins.

Given the lack of sufficient data from CBDC projects that have already been implemented, simulations and modelling can be used to help identify risks of issuing the Digital Dirham and devise effective mitigants. The CBUAE utilised various structural models and compared studies from different jurisdictions to evaluate potential adoption and disintermediation rates, the impact on the banking sector and economy, and the effectiveness of safeguards.[14] Using multiple models and different data sources helps reduce model risk. There is no single standard model that can address all key policy issues at once, and there seems to be a discrepancy between the assumptions made in academic literature and the characteristics of CBDCs envisioned by central banks (Bindseil and Senner, 2024b).

Figure 4. Simulated Share of Non-Interest-Bearing Retail Digital Dirham in Broad Money (M3, in %)



Source: authors (based on Gross and Letizia (2023)). *Note:* Columns (2)-(3) are simulated counterfactual economic adoption of the Digital Dirham. The first column represents the current UAE economic values prior to introducing the Digital Dirham. Column (2) assumes the CBDC has an intrinsic utility equal to deposits (i.e., it is perceived as having the same accessibility, efficiency and cost as deposits), while Column (3) assumes the CBDC has an intrinsic utility equal to cash. The scale of the y-axis begins at 85% to better highlight what money types are displaced by CBDC issuance.

Baseline simulations using a structural model for CBDC adoption suggest that the share of Digital Dirham – if non-remunerated – could reach 5% of M3 money supply (Figure 4 and Annex 3). Based on results from an adapted version of the agent-based model of Gross and Letizia (2023),[15] the Digital Dirham mostly substitutes bank deposits (rather than cash) in a high-adoption scenario.[16] The upper end of the simulated adoption range (5%) is not too far from the estimates available from similar studies in other jurisdictions,[17] including recent findings by Burlon and others (2024) whose DSGE model (calibrated to the Euro area economy) suggests that the optimal amount of a CBDC lies between 15 and 45 percent of quarterly GDP, which would translate into a range of 2.4% to 7.2% of M3 money supply in the UAE. While the model is designed to align with the features of the UAE economy, additional country-specific factors that were not explicitly accounted for in the model could result in higher adoption rates. For instance, the use cases for the Digital Dirham (e.g., implementing the Digital Dirham for unbanked, low-income migrant workers and facilitating automatic VAT refunds for tourists) may further drive adoption rates. Nevertheless, this would not necessarily result in bank disintermediation as potential users in these scenarios tend not to hold bank accounts.

A high adoption rate seems to have only a modest effect on banking sector performance. A simple framework can be used to evaluate how the adoption rate of the Digital Dirham would impact bank profitability and lending rates for various levels of deposit outflows (BIS, 2021). Even in a scenario with the Digital Dirham accounting for 5% of M3 money, the presence of structural excess reserves in the UAE banking sector mitigates the risk of disintermediation as any deposit displacement would not impact banks' marginal funding cost (and associated lending/investment decisions).[18] In the unlikely event that banks do not draw down their excess reserves, they would

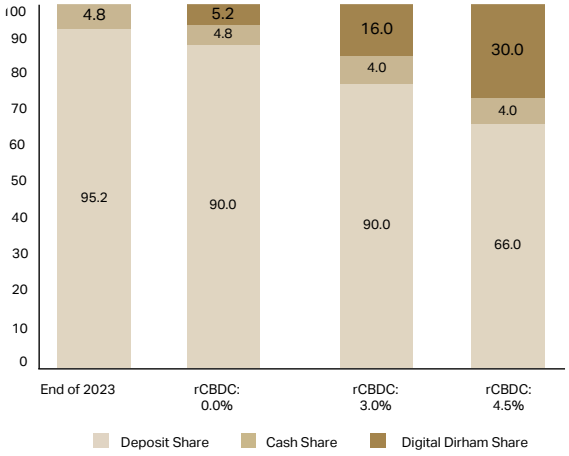
require additional funding to maintain their liquidity buffers under CBUAE's prudential liquidity requirements, which comprises the liquidity coverage ratio (LCR) for the five largest banks and the eligible liquid assets ratio (ELAR) for smaller banks. If more costly wholesale funding is used to substitute the depleted high-quality liquid assets (HQLAs), the effect on banks' net interest margins (NIMs) would be minimal. For a non-remunerated Digital Dirham, the NIM could decrease by 0.1 percentage points from 2.7% at the end of 2023 (Figure 5). Conversely, keeping NIM unchanged would require banks to increase the lending rate by 0.2 percentage points.

However, introducing a remunerated Digital Dirham could lead to significant financial disintermediation (Figure 5). For instance, if the Digital Dirham pays interest close to the UAE's policy rate (i.e., the CBUAE's Base Rate), there could be a notable decrease in the proportion of bank deposits in M3 money supply. In this situation, the CBUAE would have to expand its balance sheet considerably by providing sufficient liquidity at the policy rate to uphold the current floor-system for managing short-term interest rates. Additionally, CBUAE liquidity facilities might be utilised more frequently, potentially impacting bank profitability, increasing borrowing costs, and reducing credit availability in the long run. Nonetheless, it is important to note that the lack of remuneration and the restrictions on holding and transactions in the Digital Dirham will prevent such scenarios from occurring.

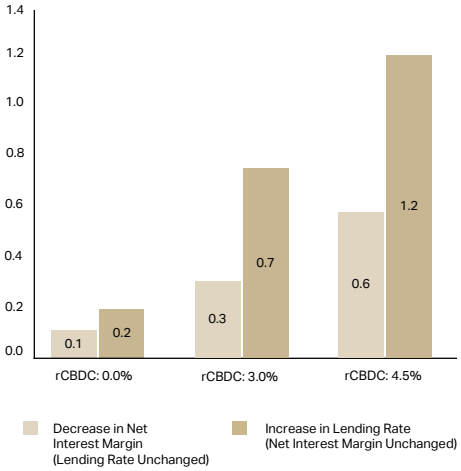
Holding limits are essential for managing deposit withdrawals during stress periods. For retail users, they should be calibrated to the income distribution and payment patterns so that the Digital Dirham can be used for daily transactions without restrictions. Implementing waterfall and reverse waterfall mechanisms that connect the Digital Dirham with current accounts can help achieve this goal. Holding limits help banks mitigate disintermediation risks from deposit outflows to the Digital Dirham during times of stress. While there is limited literature on holding limits, the European Central Bank (ECB) suggests a threshold of EUR 3,000, and the Bank of England recommends a range of GBP 10,000-20,000 (Bindseil and others, 2020). Although determining the optimal limit can be challenging, Bidder and others (2024) have proposed an optimal holding limit for the Euro area of EUR 1,500-2,500 based on a DSGE model that considers multiple equilibria and bank runs.

Figure 5. Impact of Interest-Bearing Retail Digital Dirham (simulated share in broad money (M3) [left chart] and expected impact on bank profitability and loan rates [right chart], in %)

Panel A: Share* in Broad Money (M3, in %)



Panel B: Expected Impact on Bank Profitability and Loan Rates (in pp)



Source: authors (based on Gross and Letizia (2023) and BIS (2021)). *Note:* */* simulated. Panel A shows the shares of cash, deposits and Digital Dirham in overall monetary aggregate – M3, where columns (1)-(4) compare the starting position (end of 2023) with simulated counterfactual adoption of the Digital Dirham under the different remuneration rates. Panel B illustrates how the Digital Dirham would affect banks' net interest margin and lending rate to preserve their net interest margin (while keeping banks' LCR unchanged). In this scenario, the banks would replace the deposits that shifted to the Digital Dirham with higher-cost wholesale funding, assuming all other factors remain constant.

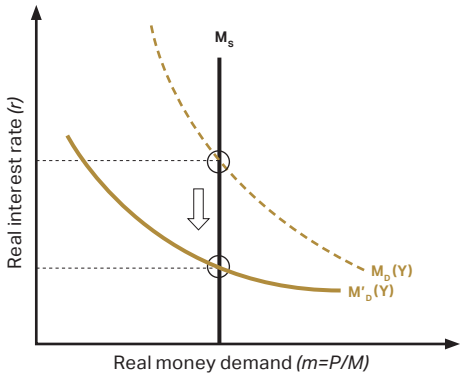
The introduction of the Digital Dirham will necessitate adjustments to the current operational aspects of the financial stability function to manage any potential negative consequences. This will involve incorporating Digital Dirham-related components into the surveillance function and stress tests. The impact of the Digital Dirham as a new payment and liquidity management tool on banks' balance sheet size, profitability, and the interaction between solvency and liquidity should be included in standard regulatory solvency and payment system stress tests, including deposit outflow assumptions. Continuous monitoring of adoption rates and potential deposit outflows help inform adjustments to holding limits and other CBDC parameters as needed to maintain financial stability.

2.2. Monetary Policy Implications

The issuance of Digital Dirham – if non-remunerated – is unlikely to meaningfully impact monetary policy (and related transmission channels).[20] If the Digital Dirham is not interest-bearing and is primarily used for transactions, it would not compete with banks for deposits. In this case, the availability of interest-sensitive borrowing and saving options would remain broadly the same and would not affect consumption and saving decisions influenced by interest rates (Mehrotra and Nadhanael, 2016).[21] This also means that monetary policy transmission channels

related to interest rates, lending, and asset prices would not be impacted in any significant way. Additionally, the pegged exchange rate system largely eliminates the exchange rate channel of monetary policy. Since foreign holdings of the Digital Dirham will be restricted, they would not affect the scale or speed of temporary capital flows balancing out differences in domestic and foreign real interest rates.

Figure 6. Impact of CBDC on Real Money Demand



Sources: authors, Jobst and Lin (2016). *Note:* MS=money supply, MD=money demand, P=price level, M=total money stock.

However, the introduction of the Digital Dirham will expand access to non-cash central bank money to the general public and could increase the participation of unbanked individuals, thereby improving the efficacy of monetary policy.[22] Additionally, the Digital Dirham, like other digital payment methods, is expected to lower cash handling expenses and mitigate counterfeiting risk, enabling households to engage in more transactions and increase the velocity of money by reducing opportunity costs as less physical cash needs to be held.[23] These factors could enhance the impact of monetary policy through the interest rate and asset price channels, as well as lead to improved financing conditions by effectively lowering real interest rates,[24] assuming all other factors remain constant (Figure 6).

The introduction of a remunerated Digital Dirham would change how monetary policy is currently carried out. The CBUAE currently uses a floor interest rate system, where the remuneration rate of liquidity surplus is the main policy rate (Base Rate). Surplus liquidity on the CBUAE's balance sheet makes it easy to maintain this system. However, an interest-bearing CBDC could decrease excess reserves through disintermediation, which would require changes to the implementation of monetary policy, such as adjusting the desirable level of excess reserves. For instance, as real money demand declines (Figure 6), a significant conversion of bank deposits into Digital Dirham could reduce (remunerated) bank reserves below the amount required to anchor money market rates (Caccia and others, 2024).

Irrespective of remuneration considerations, the implementation of the Digital Dirham will require some adjustments to operational aspects of monetary policy, including liquidity forecasting and the rules governing the CBUAE's liquidity facilities (Kunaratskul and others, 2024). Banks will need

to treat their holdings of Digital Dirham as being equivalent to reserves, with corresponding changes to regulatory treatment, liquidity management facilities, and access to CBUAE facilities.[25] Relatedly, the introduction of the Digital Dirham will also affect the CBUAE's liquidity forecasting function, as daily forecasts of banks' reserves are used to guide open market operations (if deemed necessary) to provide liquidity to (or withdraw liquidity from) the banking sector.[26] If the Digital Dirham makes it easier for foreigners to hold domestic currency, high external holdings could add uncertainty to forecasting FX flows as autonomous factor, complicating the calibration of open market operations. While the accuracy of liquidity forecasts may be impacted during the initial adoption of the Digital Dirham, the CBUAE's advanced forecasting models can be refined over time to mitigate any forecasting errors.

The Digital Dirham could pose challenges for banks in managing their liquidity and introduce new operational risks. The implementation of the Digital Dirham can enhance the innovation and resilience of the payment system by enabling programmable payments and oversight features tied to the design and operational aspects (e.g., access technology and system integration). However, implementing a new payment system, alongside existing ones, could introduce new operational and liquidity risks. These risks include settlement risks that may arise from operating multiple payment systems, such as potential outages in one system. Additionally, financial institutions may view the Digital Dirham as an added cost if holdings do not count towards reserve requirements, which could discourage its use and limit adoption. Therefore, it is important to design the operational aspects of the Digital Dirham in a way that minimises complexity and liquidity management risks for financial institutions, ensuring a smooth transition and uptake.

The impact of the Digital Dirham on the CBUAE's balance sheet is expected to be relatively minor and positive in terms of seigniorage. The Digital Dirham will be considered a liability of the CBUAE, alongside cash, central bank reserves, and securities and financial instruments issued by the CBUAE (M-Bills and Islamic Certificates of Deposit). As businesses, households, and the government transfer some of their cash reserves into Digital Dirham, the size of commercial banks' balance sheets may decrease due to a reduction in deposits and circulating currency (Annex 2). However, the CBUAE's balance sheet will not undergo significant changes due to the introduction of new CBDC liabilities (which are fully covered by reserves).[27] If the transactional use of the Digital Dirham limits deposit substitution, then the issuance of the Digital Dirham will absorb excess reserves held at the CBUAE, and, thus, facilitates reaching the CBUAE's target liquidity surplus level that aligns money market rates with the policy rate; the overall size of the CBUAE's balance sheet remains constant (as required reserves remain unchanged) (Annex 3). As excess reserves are remunerated when held as overnight deposits, the CBUAE's interest payments will decrease, potentially offsetting the expenses associated with maintaining the Digital Dirham infrastructure.[28] Since CBDC liabilities, like general reserve requirements for deposits, are non-remunerated, the CBUAE's seigniorage revenue—generated from holding assets with a return higher than the cost of liabilities—is expected to increase.[29]

2.3 Cyber-Security And Operational Risk Implications

The Digital Dirham may be vulnerable to cyber-threats and illicit financial activities such as money laundering and fraud, which could erode trust in the financial system and the CBUAE. The extent of these risks will depend on the effectiveness of the Digital Dirham's digital identity framework, cyber-security and cyber resilience measures, and fraud detection tools. Adapting current policies to the Digital Dirham to identity verification can help address cyber-crime. Cyber-risks could materialise through various means, including hacking into the CBUAE's system or individual LFIs, potentially damaging the CBUAE's reputation and the perceived integrity of the UAE's financial system. Therefore, the CBUAE will carry out extensive security testing and continuously implement new security measures. Conversely, the Digital Dirham infrastructure also enhances resilience by providing an alternative payment system that can operate independently in the event of disruption of the conventional payment systems and infrastructures.

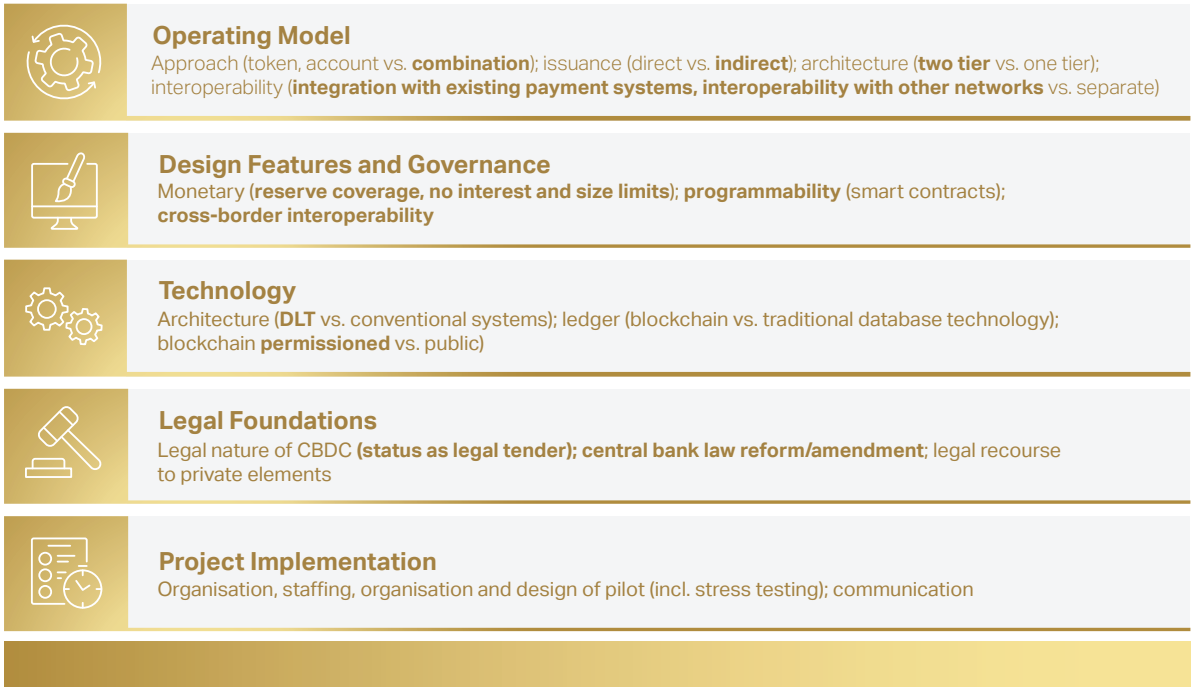
2.4 Consumer Protection

The Digital Dirham has the potential to bring significant benefits to consumers, including improved financial inclusion and access to more efficient payment methods. However, its widespread adoption as a universal form of payment also presents new challenges. It is essential to protect consumer data and privacy, while establishing a clear dispute resolution mechanism to build trust in the ecosystem. The CBUAE is actively collaborating with different stakeholders to create a strong framework that protects consumer interests, enhances digital literacy, and encourages responsible innovation in the digital currency sector.

3. Design Choices and Risk Mitigation for the Digital Dirham

The architecture and technology behind the Digital Dirham will enhance payment resilience, security and efficiency, with a view to encouraging effective adoption without disintermediating the banking sector. The Digital Dirham will provide a secure platform that encourages financial innovation and enables various use cases for retail, wholesale, and cross-border transactions. Figure 7 below provides a summary of the main design considerations.

Figure 7. Overview of Key Design Considerations for the Digital Dirham

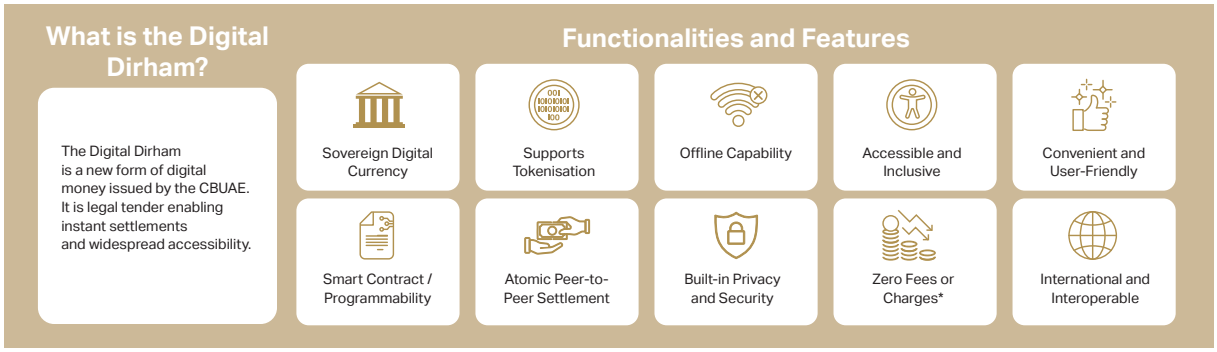


Sources: Söderberg and others (2022) and authors. *Note:* DLT=distributed ledger technology; RTGS=real-time gross settlement system; attributes in **bold** font indicate the distinct policy choices the CBUAE has made regarding the issuance of the Digital Dirham in terms of operating model, design, governance, legal status and technological platform.

The Digital Dirham is at the forefront of CBDC development globally, boasting high reliability, flexibility, and scalability (Table 2 and Figure 8). Its design and governance reflect best practices (including policy choices in other jurisdictions) but also incorporate unique features not typically seen in other CBDCs, such as access for non-residents, offline availability, and cross-border payment capabilities. Similar to other jurisdictions with CBDCs (Annex Table A1), the Digital Dirham also follows an intermediated distribution model with universal wallet-based access through user wallets, with limits on CBDC holdings and transaction volumes (Annex 4).

An integrated and secure platform will effectively target end-users and intermediary involvement through various use cases to encourage innovation and adoption. The adoption rate of countries that have already introduced CBDCs has been generally low (Noll, 2024), which could be an operational risk for the Digital Dirham. Some of the frequently reported reasons for low adoption rates among individuals and businesses include limited use cases, low awareness, poor user experience, insufficient merchant acceptance, challenges in integrating with existing payment systems, perceived public mistrust with data privacy concerns, technical difficulties, and consumer preferences (Koonprasert and others, 2024). Against this background, the Digital Dirham has been designed to meet the needs of the broader community and offer innovative use cases to drive effective adoption.

Figure 8. Definition and Characteristics of the Digital Dirham



Source: authors. *Note:* */ on basic services.

The Digital Dirham will have full convertibility to other forms of Dirham-denominated money, such as the other types of the central bank money and bank deposits. The stability of the UAE monetary system necessitates that all types of Dirham-denominated money be interchangeable and valued equally, regardless of their form. Bank deposits should be readily exchangeable for cash or transferable to another bank without restrictions. The Digital Dirham will share similarities with cash in terms of convertibility and consistency with other forms of money, like bank deposits, albeit with certain limitations to maintain financial stability.

The reserve equivalency of the Digital Dirham will also extend to regulatory requirements. The introduction of the Digital Dirham will establish an additional payment system that will run alongside the UAE Funds Transfer System (UAEFTS). To address customer needs, LFIs will need to maintain a certain amount of Digital Dirham in their accounts, particularly when the UAEFTS is not operational. Therefore, it is crucial that these funds are treated similarly to reserves. This involves considering LFIs' holdings of Digital Dirham as part of reserve requirement fulfilment and for facilitating the execution of the Overnight Deposit Facility. This requirement ensures that LFIs do not view Digital Dirham as a burden, which could deter them from supporting broader adoption.

Maintaining consistency with reserves also necessitates providing liquidity support for the Digital Dirham. The introduction of the Digital Dirham will affect several existing payment systems in the UAE. This adds operational risk as liquidity support operations are conducted through the UAEFTS, while withdrawal requests may originate from other systems. It also entails liquidity risk in cases where the UAEFTS becomes unavailable due to unforeseen circumstances. Therefore, infrastructure for the Digital Dirham will be established to facilitate essential liquidity support operations in Digital Dirham, encompassing overnight and intraday lending facilities, as well as term lending facilities if deemed necessary. This is crucial for upholding the consistency of the monetary policy framework, even in the event of disruptions to a specific payment system.

Table 2. Cross-country Comparison of CBDC Characteristics

		CBDC Design	Remuneration?	Quantitative Restrictions?	Tiering?	Non-resident Wallet?	Anonymity?	Offline Availability?	Cross-Border Payment
Launched	**Bahamas**	Intermediated / hybrid	No	Yes	Yes	Yes	Yes (for lower tier)	Yes	Future project
	ECCU	Intermediated / hybrid	No	Yes	Yes	No	Yes (for lower tier)	No	Future project
	Jamaica	Intermediated / hybrid	No	Yes	No	No	Yes	No	Limited [3]
	Nigeria	Intermediated / hybrid	No	Yes	Yes	No	Yes (for lower tier)	Yes	Yes (exploring)
Advanced Stage / Pilots	**P.R. China**	Intermediated / hybrid	No	Yes	Yes	Yes	Yes (for lower tier)	Yes	Yes
	Euro Area	Intermediated / hybrid	No	Yes	Undecided	Undecided	Pseudo	Yes (exploring)	Experimenting / int. collaboration
	Japan	Intermediated / hybrid	Undecided	Yes	No	n.a.	No	Yes (exploring)	Yes (exploring)
	Sweden	Intermediated / hybrid	Undecided	Exploring	n.a.	n.a.	Undecided	Yes (exploring)	Experimenting / int. collaboration
	Türkiye	Intermediated / hybrid	Undecided	Yes	Yes	No	Some [2]	Yes	Yes (exploring)
	UK	Intermediated / hybrid	No	Yes [1]	Undecided	Yes	Private	Yes (exploring)	Yes (exploring)
	UAE	Intermediated / hybrid	No [1]	Yes	Yes	Yes	Pseudo	Yes	Yes

Sources: Söderberg and others (2022), Ree (2023), various central banks, and authors. *Note:* 1/ current decision, subject to review after initial rollout; 2/ decentralised identifier (DID); 3/ connected with RTGS system provided by CMA (which has 60 central bank clients).

3.1. Operating Model And Technology

The Digital Dirham will be distributed by LFIs as financial intermediaries. The CBUAE has chosen an intermediated distribution model, where Digital Dirham holdings are a direct liability of the CBUAE as the sole issuer, but distribution, wallets, and customer payments will be managed by LFIs. Digital Dirham wallet providers will include LFIs (banks, exchange houses, payment service providers) as well as FinTechs with store value facility (SVF) licences. By involving the private sector, the CBUAE can maintain control over essential functions (such as issuing the Digital Dirham) while delegating certain tasks to private entities to simplify legal and operational processes (Bouza and others, 2024). Furthermore, this operational model helps mitigate disintermediation risks and encourages LFIs to deliver innovative services and solutions based on the capabilities of the Digital Dirham rather than relying solely on the CBUAE for innovation.[30]

Table 3. Cross-country Comparison of Private Sector Involvement in CBDC Operating Models

		Issuing		Validation		Ledger Update		AML-CFT/KYC		User Interface		User Data[1]		Customer Service	
		OWN-ER[2]	EXEC-UTOR	OWN-ER	EXEC-UTOR	OWN-ER	EXEC-UTOR	OWN-ER	EXEC-UTOR	OWN-ER	EXEC-UTOR	OWN-ER	EXEC-UTOR	OWN-ER	EXEC-UTOR
Launched	Bahamas	Central Bank	Central Bank	Central Bank	Central Bank	Central Bank	Central Bank	Central Bank	Private	Both	Private	Private	Private	Private	Private
	Jamaica	Central Bank	Central Bank	Central Bank	Central Bank	Central Bank	Central Bank	Central Bank	Central Bank	Central Bank	Private	Private	Private	Private	Private
	Nigeria	Central Bank	Central Bank	Central Bank	Central Bank	Indeterminate[3]	Indeterminate[3]	Private	Private	Private	Private	Private	Private	Private	Private
Advanced Stage / Pilots	China	Central Bank	Central Bank	Central Bank	Central Bank	Central Bank	Central Bank	Both	Private	Private	Private	Private	Private	Private	Private
	Euro Area	Central Bank	Central Bank	Central Bank	Central Bank	Central Bank	Both	Private	Private	Private	Private	Private	Private	Private	Private
	Japan	Central Bank	Central Bank	Central Bank	Both	Central Bank	Central Bank	Central Bank	Private	Private	Private	Indeterminate[3]	Indeterminate[3]	Indeterminate[3]	Indeterminate[3]
	Sweden	Central Bank	Central Bank	Central Bank	Both	Both	Both	Private	Private	Private	Private	Private	Private	Private	Private
	Türkiye	Central Bank	Central Bank	Central Bank	Central Bank	Indeterminate[3]	Indeterminate[3]	Private	Private	Private	Private	Private	Private	Private	Private
	UK	Central Bank	Central Bank	Central Bank	Central Bank	Indeterminate[3]	Indeterminate[3]	Indeterminate[3]	Indeterminate[3]	Private	Private	Private	Private	Private	Private
	UAE	Central Bank	Central Bank	Central Bank	Private	Central Bank	Private	Both	Both	Both	Both	Private	Private	Private	Private

Colour coding: Central Bank; Private; Both; Indeterminate[3]

Sources: Söderberg and others (2022), central banks, and authors. *Note:* AML/CFT=anti-money laundering/combating the financing of terrorism; KYC=know your customer; 1/ e.g., central banks have access to data stored by intermediaries; 2/ when considering the allocation of roles among different parties, it is important to differentiate between the entity that owns the technical system required to perform a particular function and the entity responsible for executing that function. These entities may not always be identical; 3/ information is not available and/or decision has not been made (exploratory phase).

The intermediated distribution model will be enhanced by a hybrid wallet-based access model. The Digital Dirham will be based on a hybrid CBDC architecture that combines account- and token-based approaches, where wallets have account identifiers and all transactions will be recorded using permissioned distributed ledger (DLT) technology. DLT will ensure immutability and strong privacy safeguards through pseudonymity, while also enabling integration with existing payment systems and new digital asset networks. Ensuring strong controls to mitigate financial crime requires some form of identification for system access while maintaining privacy protections. Digital identification protocols for system access and payment traceability will deter the misuse of the Digital Dirham for illicit activities.

The operating model of the Digital Dirham involves strong private sector participation to drive financial innovation (Table 3). The CBUAE shares responsibility for KYC-AML verification and user interface development data management, payment product development and customer service with the private sector. However, the CBUAE maintains control over critical functions related to the issuance and redemption of the Digital Dirham and the validation of transactions and ledger updates, utilising a private, permissioned DLT as the underlying technology solution. Close public-private collaboration enables the introduction of new functionalities, features, and use cases (e.g., smart contracts, tokenisation, and programmability) while mitigating disintermediation risks (including by setting appropriate limits) and encouraging LFIs to develop new products and services to end-users based on the capabilities of the Digital Dirham.

3.2. Design Features And Governance

The Digital Dirham will be launched as an unremunerated CBDC.[31] Remuneration could incentivise adoption, increase competition in the deposit market, and act as an extra monetary policy tool. However, this approach would not align with the policy objective of the Digital Dirhams being used primarily for transactional payment purposes. Remuneration could also impact the financial system structurally and lead to increased costs for the CBUAE. Currently, no benchmark countries have implemented or announced interest rates on CBDC (Table 2). If it becomes clear that the benefits of remuneration outweigh the drawbacks, this decision may be reconsidered in the future.

Users will be required to adhere to certain limits. Various levels of transaction and/or holding limits ("tiers") will be set for residents, businesses, and tourists/visitors. By linking Digital Dirham wallets to bank accounts, automated waterfall and reverse waterfall processes could be set to prevent transactional restrictions under normal conditions, so that users can purchase large-value goods and services. Clear rules on access restrictions (determining who can own the Digital Dirham) and the ability for individuals to have multiple Digital Dirham wallets are important aspects of ensuring that usage is primarily for transactional purposes.[32] Enhanced liquidity stress testing techniques employed by the CBUAE will be implemented to anticipate higher potential deposit outflows, guaranteeing that banks maintain adequate high-quality liquid assets (HQLAs) and enabling the CBUAE to serve as a lender of last resort effectively. The limits will be designed not to harm adoption and facilitate the practical utilisation of the Digital Dirham while supporting transactions.

A circuit breaker function can be used in rare cases to protect financial stability. It can be triggered to enforce sanctions or in extreme situations like capital outflows and bank runs, based on clear guidelines and effective communication. With well-planned limits in place, the need for the circuit breaker function should be minimised.

The CBUAE will develop bilateral and multilateral CBDC arrangements to facilitate cross-border payments and offshore holdings of the Digital Dirham. As part of the first phase of implementation of the Digital Dirham, the CBUAE demonstrated that multi-CBDC platforms can improve the efficiency of cross-border payments. Given the intensifying trade and capital flow connectivity between the UAE and other markets, especially in the MENA region, the cross-border application of the Digital Dirham is highly attractive. Additionally, the cross-border use of the Digital Dirham can enhance financial inclusion for a significant portion of the population that remits funds abroad.

The risks linked to the cross-border Digital Dirham can be managed effectively by using technological solutions and imposing access restrictions. Risks related to the availability of the Digital Dirham in foreign countries can be reduced through a combination of technical measures (smart contracts) and reporting/compliance requirements to provide transparency on the value and volume of transactions as well as user identity. These measures can also be expanded to incentivise repatriation of Digital Dirham. Incorporating smart contracts and other technological tools in the Digital Dirham can help reduce volatility in capital flows while maintaining an open capital account.

3.3. Legal Considerations

The issuance and distribution of CBDCs require a strong legal and regulatory framework. Legal amendments are essential to ensure legal clarity for private transactions involving CBDC and to improve the regulatory framework for CBDC operations, including the supervision and regulation of CBDC service providers.[33] Therefore, the UAE has taken a proactive approach in developing a favourable and robust legal framework for organising CBDC.[34] A detailed legal gap analysis was completed, including reviewing other laws, and providing recommendations as part of a comprehensive CBDC legal and regulatory framework. The CBUAE worked with several ministries to identify and make legal provisions to issue the Digital Dirham with full legal certainty.

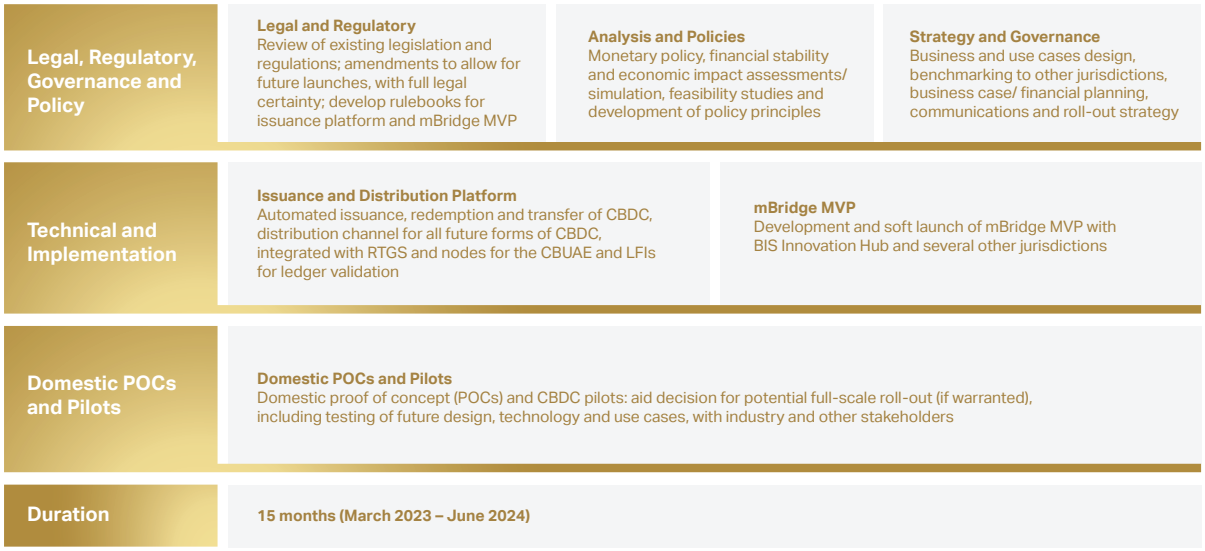
The Digital Dirham has already been authorised as legal tender (Annex Table A2), alongside physical bankotes and coins, and should be treated equally under the law. One of the defining characteristics of a CBDC is its recognition as legal tender in the jurisdiction where it has been issued. Accordingly, using a CBDC entitles a debtor "to discharge monetary obligations by tendering currency to the creditor" (Bossu and others, 2020, p. 8). In other words, within a specific jurisdiction, a CBDC must be accepted as a valid form of payment to fulfil any payment obligations, whereas other electronic payment forms can be declined (EDPS, 2024). On 2 October 2023, the UAE enacted Federal Law No. 54 of 2023, modifying *Federal Law No. 14 of 2018 concerning the central bank and the Regulation of Financial Institutions and Financial Activities* ("CBUAE Law"), thereby expanding the definition of currency to encompass digital currency (Boustany and Safar-Aly, 2023). Article 56 of the CBUAE Law, as amended, now provides that "currency notes and digital currency issued by the central bank shall be legal tender for payment of any amount up to their full face value." One important implication of legal tender status is that the Digital Dirham can legally satisfy debt.

A robust legal framework for the implementation of the Digital Dirham helps build trust. The recent legal amendment gives the CBUAE the power to determine the characteristics, design, possession requirements, and other aspects of the digital currency subject to Board of Directors approval. This allows the CBUAE to stay up to date with future developments, while ensuring the necessary legal certainty for CBDC, which is backed by its legal tender status under the CBUAE Law.[35]

4. Current Status Of The Digital Dirham Development And Implementation

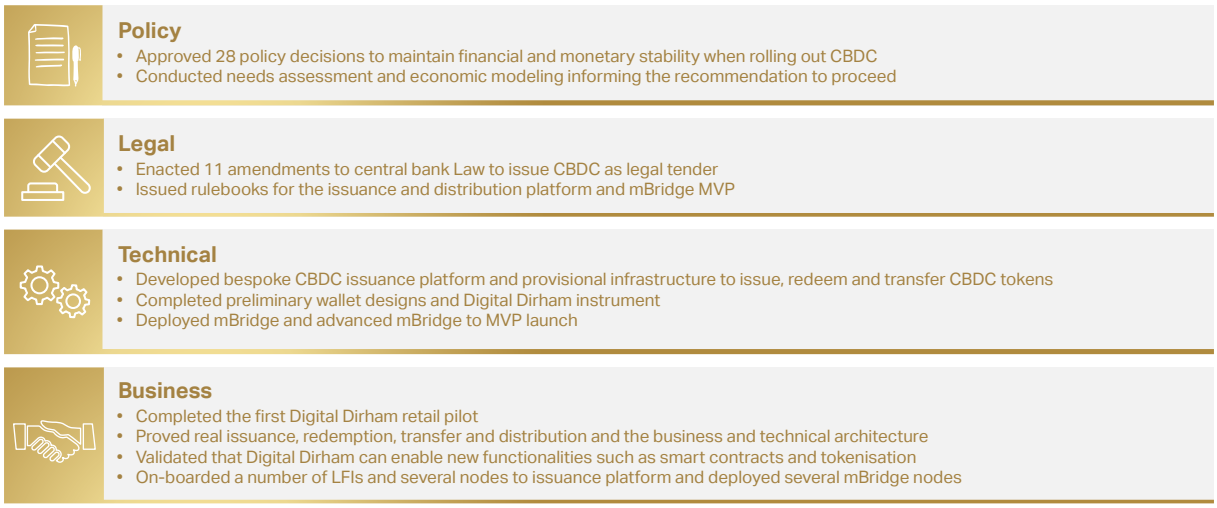
The CBUAE has made substantial progress in designing, building, testing and deploying the Digital Dirham as a universal payment instrument for retail, wholesale and cross-border use (Figures 9 and 10).[36] In January 2024, the first Digital Dirham as legal tender was issued as the first cross-border payment on the mBridge platform. The CBUAE played a key role in Project mBridge reaching minimum viable product (MVP) stage (CBUAE, 2024b). The retail pilot conducted in 2024 evaluated the future design, technology and benefits of a retail CBDC. During the first phase of implementation (Phase 1), the CBUAE (1) built a bespoke DLT-based issuance platform integrated with the CBUAE's reserve banking system to enable seamless exchanges and transfers between LFI's Digital Dirham and reserve accounts and (2) on-boarded LFIs to the issuance platform for the Digital Dirham. As part of the retail pilot in collaboration with several LFIs, the CBUAE tested four "digital economy use cases" to assess the feasibility and effectiveness of the Digital Dirham as an innovative universal payment method.

Figure 9. CBUAE's Comprehensive Digital Dirham Project (Phase I)



Source: authors.

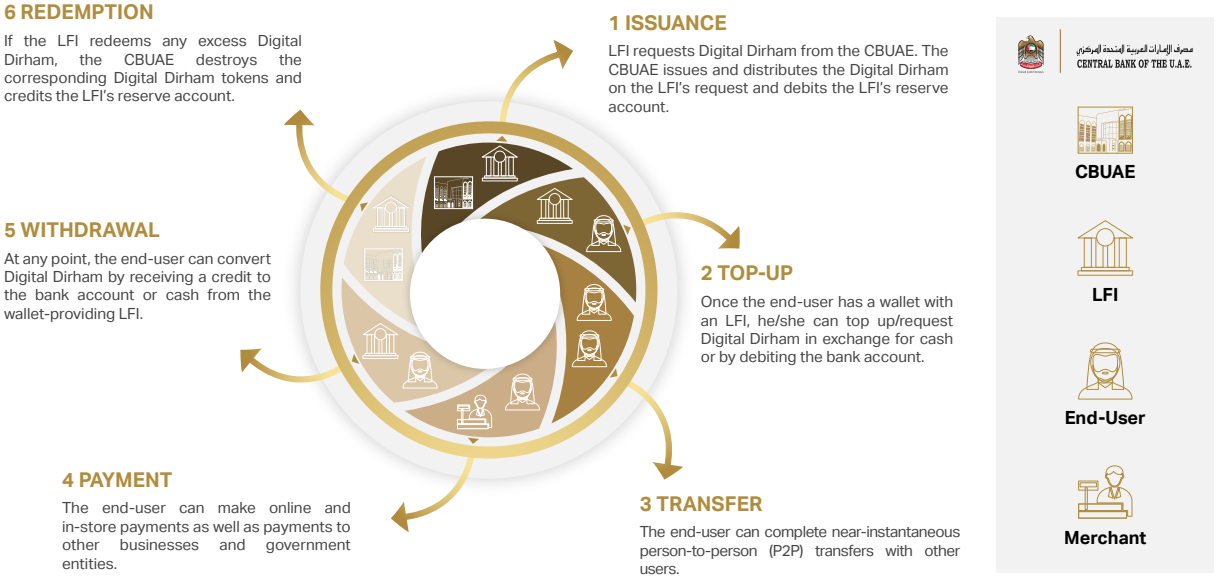
Figure 10. Digital Dirham Phase I Achievements



Source: authors.

The retail pilot for the Digital Dirham involved four digital economy use cases and tested the entire CBDC lifecycle (issuance, redemption, transfer, and distribution to end users) (Figures 11 and 12). These use cases included fractional ownership of tokenised assets, a smart tourist wallet, smart social benefit payments, and a parent/child sub-wallet, which demonstrated how the Digital Dirham can help speed up the evolution of the digital economy through its various functions and attributes. For example, in the "smart social" use case, the Ministry of Community Development (MOCD) distributed food subsidies via programmable Digital Dirham. The MOCD could also program where such Digital Dirham could be spent and monitor the distribution and usage of government benefits in real time. In addition, the CBUAE created a prototype Digital Dirham App, which allows end-users to select their wallet provider, conduct payments, top up their accounts, acquire Digital Dirham, redeem it, and carry out specified use cases.

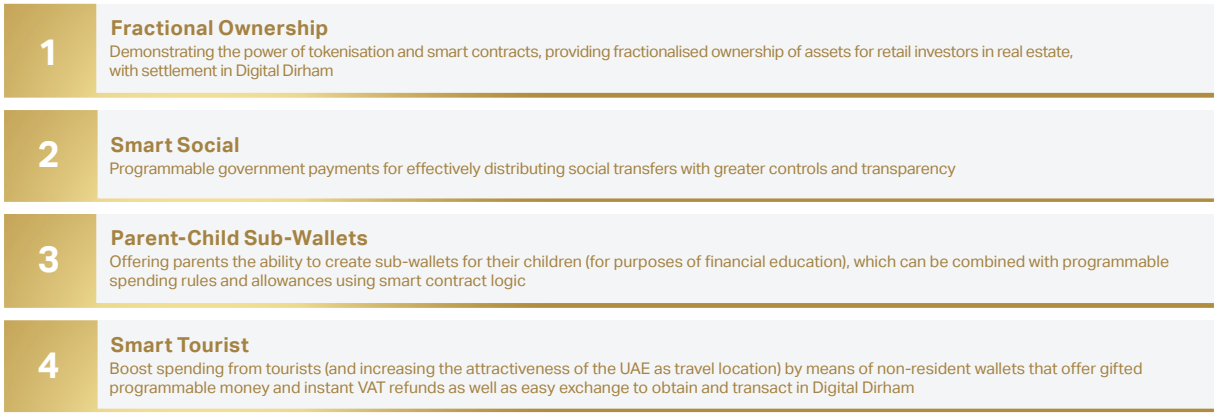
Figure 11. The Retail Digital Dirham Lifecycle



Source: authors.

The Digital Dirham will also enable cross-border payments and offshore holdings. In 2022, the CBUAE was the first central bank in the MENA region to conduct a real-value cross-border CBDC pilot through Project mBridge, in collaboration with the Hong Kong Monetary Authority, the Bank of Thailand, the Digital Currency Institute of the People's Bank of China, and the Bank for International Settlements. Project mBridge is the world's first operational multi-CBDC platform, facilitating efficient, cost-effective, and instant cross-border payment and settlement in central bank money.[37] The CBUAE and other participating central banks have now deployed the network and nodes, and commercial banks have started conducting real-value transactions on a continuous basis since April 2024.[38] The CBUAE will continue to assess the benefits and risks of Project mBridge, explore alternative bilateral and multilateral agreements, and ensure interoperability with other CBDCs to support cross-border payments while maintaining control in the technical design of the Digital Dirham.

Figure 12. Overview of Digital Dirham Pilot Use Cases



Source: authors.

The CBUAE is prepared to advance to the gradual rollout of the retail and wholesale as well as cross-border versions of the Digital Dirham, following a detailed implementation plan and policy guidance. The CBUAE, in partnership with relevant government bodies, has developed an implementation strategy and legislative roadmap to ensure that policy decisions are accompanied by necessary legal and regulatory adjustments, including consumer protection laws. This phased rollout mirrors the approach taken by other countries launching CBDCs, fostering trust in the secure and widespread adoption of the Digital Dirham. It also allows for continuous monitoring of CBDC advancements, facilitating the exchange of knowledge and insights among early adopters to expedite adoption and usage. This incremental method enables the recognition of emerging trends and lessons learned. The gradual rollout of the Digital Dirham will also ensure that key policy principles and considerations are addressed at each stage of development. As the project advances and potential risks are deemed to be no longer relevant, measures originally incorporated to mitigate those risks will be progressively relaxed. Maintaining open communication with intermediaries and users, establishing clear guidelines, understanding their motivations, business models, and requirements will promote adoption.

To facilitate smooth adoption, the CBUAE will initially introduce the Digital Dirham with essential use cases. Domestically, the CBUAE will be launching the Digital Dirham for retail and wholesale use, including fully implementing the four digital economy use cases.[39] The retail Digital Dirham will also support peer-to-peer (P2P), online and in-store payments, business-to-consumer (B2C), business-to-business (B2B), and government-to-consumer (G2C) transactions, and other use cases enabled by programmability.[40] Stakeholder feedback regarding business value, consumer benefits, and potential for innovation has guided the selection of these use cases (Figure 12), with ongoing collaboration with government departments to integrate Digital Dirham into the UAE's payment ecosystem.

Input from stakeholders is crucial to ensure that the Digital Dirham fulfils its intended purpose. Without feedback from users and intermediaries, even well-considered design decisions could lead to a technically functional product that lacks broad acceptance. To foster stakeholder participation, the CBUAE is arranging focus groups and surveys involving financial institutions, households, businesses and tourists. Furthermore, for the global rollout of the Digital Dirham, the CBUAE may establish a Digital Advisory Committee. The CBUAE is also actively collaborating with stakeholders from various government departments to enhance understanding of the Digital Dirham and its integration into the UAE's payment ecosystem.

Realising the complete capabilities of the Digital Dirham will require collaboration with domestic and foreign partners. The CBUAE is working closely with the industry to ensure that the Digital Dirham plays a vital role in the UAE's financial system. To realise the full benefits of the Digital Dirham's cross-border application, the CBUAE collaborates with other central banks, commercial banks, non-bank financial institutions and international bodies to ensure interoperability and connectivity. In this context, the CBUAE's active involvement in Project mBridge as a key member is a significant step in fostering trust and encouraging international cooperation.

4. Conclusion

Many central banks are exploring the introduction of CBDCs to address a range of policy objectives. Key benefits include enhancing the efficiency of the payment system, increasing financial access for the unbanked and aligning monetary policy implementation with technological advancements in the digital economy. However, the deployment of CBDCs can pose risks to financial and monetary stability, and design choices can impact the risk of financial crime. Therefore, the completion of a comprehensive evaluation of the benefits and risks, considering country-specific factors, was a crucial step on the road towards implementation.

The CBUAE stands ready to introduce the Digital Dirham to support the UAE's digital transformation strategy. The CBUAE has already worked with the financial ecosystem and stakeholders to ensure adoption through the implementation of high-priority digital economy use cases. Various key design features, including the intermediated distribution model and the two-tier hybrid architecture with a wallet model for access, have been incorporated to mitigate potential risks associated with the introduction of the Digital Dirham. Additional design elements, such as appropriate limits and non-remuneration, are intended to encourage the use of the Digital Dirham as a means of payment (and not as a substitute for bank deposits and savings accounts), thereby preserving the existing financial system hierarchy. These design features, among others, are being implemented to safeguard monetary and financial stability while also emphasising cyber-security, privacy, and the fight against financial crime.

By taking a precautionary approach to implementation, the CBUAE is increasing the likelihood of the Digital Dirham achieving its full potential. The Digital Dirham was developed with a focus on ensuring that benefits outweigh potential risks, with ongoing reviews to further mitigate risks and ensure the successful adoption of the Digital Dirham. The CBUAE will continue to assess the impacts of CBDC implementation and adjust the design of the Digital Dirham as needed.

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Annex

Table A1. Summary of Operational/Near-Operational CBDC Projects

Country *CBDC Name*	**Bahamas** *Sand Dollar*	**ECCU*** *DXCD/DCash*	**Jamaica** *JAM-DEX*	**Nigeria** *eNaira*
Launch Date	20 Oct. 2020	20 March 2021	20 May 2022	25 Oct. 2021
Circulation Date	31 Jan. 2022	20 March 2022	Undeclared	1 Aug. 2022
Share of Circulating Currency	<0.10%	0.16%	Undeclared	0.15%
Distribution Model	Hybrid	Hybrid	Hybrid	Hybrid
Exchange Rate	Fixed to USD	Fixed to USD	Floating	Managed USD Float
Bank Account Req'd	No	No	No	●
Design/Policy Choices				
Account Size	✓	✓	●	✓
Transaction Frequency	●	●	●	✓
Transaction Size	✓	✓	●	✓
Geographical Use	✓	●	✓	●
Holder Type	●	●	●	✓
Interest Rate	0%	0%	0%	0%
Transaction Cash Back	●	●	2%	No
Transaction Fees	●	No	●	●
Waterfall	✓	●	●	●
Expiration Date	●	●	●	●
CBDC-as-Collateral	●	●	●	●

Sources: Bank of Jamaica (2022), Central Bank of the Bahamas (2022), Central Bank of Nigeria (2021), Lukonga (2023), Appendino and others (2023), Zamora-Pérez and others (2022). *Note:* DCash is scheduled to exit pilot phase 12 months after launch date; "●" indicates no information could be found, or available information was either contradictory or unclear.

Table A2. Cross-Country Comparison of the Legal Aspects of CBDC Initiatives

Jurisdiction	Legal Definition of CBDC (based on original text)	Legal Approach
Eastern Caribbean Currency Union (ECCU)[1]	"'Dcash' is the digital version of the East Caribbean Dollar issued by the Eastern Caribbean Central Bank (ECCB) and distributed by licensed bank and non-bank financial institutions in the ECCU."	Clarification of existing regulations; DCash is legal tender under currently enacted legislation
Nigeria	"'eNaira' means Electronic Naira issued by the Central Bank of Nigeria as a legal tender."	Amendment of existing regulations; no new standalone law in addition to amendments to implement within the existing legal system
Bahamas	"'Bahamian Dollar Digital Currency' (BDDC) means an electronic version of the Bahamian Dollar issued by the central bank pursuant to the authority conferred upon it by the [Central Bank of the Bahamas] Act, fully backed by reserves held by the central bank and which represents a direct claim against the central bank."	New standalone legislation to implement CBDC
Jamaica	"Central Bank digital currency means a digital form of currency, issued by the Bank [of Jamaica] under section 12(1), that is legal tender in electronic form in the island [of Jamaica]."	New standalone legislation to implement CBDC without (additional) "interpretation" law
India	"The Reserve Bank of India defines CBDC as the legal tender issued by a central bank in a digital form, which is akin to sovereign paper currency. It, however, takes a different form, exchangeable at par with the existing currency and shall be accepted as a medium of payment, legal tender and a safe store of value."	Amendment of existing regulations; no new standalone law in addition to amendments to implement within existing the legal system
P.R. China	"'E-CNY' is the digital version of fiat currency issued by the People's Bank of China (PBOC) and operated by authorised [agents], with legal tender status."	Amendment of existing legislation to implement CBDC

Sources: Bank of Jamaica (2022), Central Bank of the Bahamas (2022), Central Bank of Nigeria (2021), People's Bank of China (2021), IMF (2022), Reserve Bank of India (2022), national central banks, and authors. *Note:* 1/ ECCU comprises Anguilla, Antigua and Barbuda, Dominica, Grenada, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines.

Annex 1. Benefits and Risks of CBDCs and the Digital Dirham

Benefits

- *Enhanced payment efficiency:* enables quicker, more cost-effective and efficient payments using convenient digital solutions that are more accessible, resulting in lower operational and transaction expenses and less reliance on intermediaries; also helps businesses and individuals improve risk management through various innovative features (e.g., smart contracts).
- *Monetary sovereignty:* ensures that the national currency remains the dominant form of money in the local market while operating within a fixed exchange rate system and open capital account; mitigate any potential negative impacts caused by foreign CBDCs and/or private currencies.
- *Trust in money:* provides a regulated and stable digital currency option compared to private money amid an increasing popularity of alternative payment methods and store of value.[41]
- *Promote the digital economy and financial innovation:* supports new functionalities, features, and use cases such as smart contracts, tokenisation, and programmability, fostering a more dynamic financial sector; this leads to the development and offering of new products and services to end-users.
- *Security:* reduces tax evasion and financial crime and, in comparison to physical cash, embeds monitoring within the system.
- *Efficiency of cross-border payments:* enhances access to global payment systems and lower expenses for cross-border transactions.[42]
- *Financial inclusion:* expands access to financial services for individuals without bank accounts or with limited access to banking services, as CBDCs can be used with digital wallets offered by licensed financial institutions like money exchanges, reducing transaction fees and promoting competition in the financial sector.

Potential Risks and Challenges

- *Financial stability:* could disrupt the traditional banking sector by encouraging consumers to hold CBDCs instead of keeping their money as bank deposits.[43] Also, in times of stress or economic uncertainty, more consumers may choose to convert their bank deposits into CBDCs, potentially leading to a systemic bank run.
- *Credit conditions:* could disrupt credit creation if financial flows bypass commercial banks at scale.
- *Cyber-security:* may be at a higher risk of cyber-attacks without adequate security measures and protections, potentially eroding trust in the financial system.
- *Consumer protection:* safeguarding consumer data, ensuring transparent transactions, and addressing potential vulnerabilities are crucial for public trust.
- *Privacy*: the digital nature of CBDCs could raise concerns about user privacy if transactions can be traced in a person's digital wallet without proper controls.

Annex 2. Macroeconomic Consequences of Central Bank Digital Currencies

The introduction of CBDCs has complex macro-financial implications that have been the subject of extensive applied and theoretical research. This review explores recent literature on the potential impact of CBDCs on financial stability and monetary policy, discussing key findings, differing perspectives, and the consequences of design decisions for CBDCs.

A key issue is the potential impact of CBDCs on traditional banking models through disintermediation. Various studies suggest that the introduction of CBDCs could result in a shift from commercial bank deposits to CBDCs (Keister and Sanches, 2023; Schilling and others, 2024). This shift may decrease banks' deposit funding and their ability to provide credit. However, Kumhof and Noone (2018) as well as Chiu and others (2023) and Andolfatto (2021) suggest that CBDCs could prompt banks to offer more competitive rates to retain deposits, potentially increasing savings and improving financial inclusion. Paul and others (2024) utilise a New Keynesian dynamic stochastic general equilibrium (DSGE) model to demonstrate that the introduction of a CBDC could boost system-wide liquidity and raise deposit rates by reducing banks' market power. However, this could result in deposit outflows and decreased bank lending. They identify significant welfare benefits from a CBDC with an optimal interest rate, balancing increased liquidity for households with reduced bank profitability and lending capacity.[44]

CBDCs could also have an impact on bank profitability. If banks start using market-based financing instead of relying on deposits, it could affect their liquidity and maturity transformation (Mancini-Griffoli and others, 2018). Changes in the funding mix might also result in different risk profiles and potentially increase the procyclicality of bank lending. Keister and Sanches (2023) suggest that CBDCs might lower funding costs for banks but could also impose credit constraints that limit bank lending. The possibility of reduced credit availability due to changes in bank funding strategies, such as banks raising the cost of credit lines to offset higher deposit rates, raises concerns about the overall economic impact, as discussed by Piazzesi and Schneider (2020). However, some studies indicate that increased competition could expand the deposit base and ultimately increase credit availability (Andolfatto, 2021; Chiu and others, 2023). Barrdear and Kumhof (2016) also point out potential benefits like improved economic efficiency and lower transaction costs. In conclusion, these dynamics suggest a complex relationship between the introduction of CBDCs and bank performance, which could benefit overall welfare but also potentially lead to some financial disintermediation.[45]

There is conflicting evidence regarding the macroeconomic implications of CBDCs. Bindseil and Senner (2024a) argue that the short-term effects may be minimal if issuing CBDCs is like increasing currency in circulation (using data from the Euro area between 2007 and 2021). Niepelt (2023) as well as Brunnermeier and Niepelt (2019) also find limited adverse impacts over the long term if CBDCs do not disrupt the financial system. However, Burlon and others (2024), as well as Assenmacher and others (2023) argue that CBDCs could impact economic activity by changing reserve demand, central bank profits, and the dynamics of private consumption and lending. Abad

and others (2023) suggest that CBDCs may reduce household savings and increase real interest rates, potentially affecting output and inflation by altering the liquidity premium and impacting investment and consumption responses to economic shocks.

In conclusion, CBDCs can have various effects on the financial system, monetary policy, and economic activity. Although there are some common viewpoints in the literature, the actual impact will vary based on factors like CBDC structure, interest rates, and the level of competition with commercial bank deposits.[46] These conversations highlight the complexities of incorporating CBDCs into current monetary systems and emphasise the importance of thoughtful planning and execution to maximise benefits while mitigating risks.

Annex 3. Balance Sheet Impact of the Digital Dirham

The introduction of the Digital Dirham, as a complementary payment method to cash and electronic transfers, is expected to impact the balance sheet of the CBUAE, the banking sector, and the rest of the economy. The impact of the Digital Dirham on financial flows in the UAE economy will depend on its adoption, how banks react to potential changes in deposits, and overall liquidity conditions. Two scenarios can be considered for how the Digital Dirham will affect financial flows: one where it replaces physical cash and another where it replaces deposits, leading to different responses from banks. These scenarios are depicted using simplified balance sheets of the CBUAE, domestic banks, and the general public (comprising households, businesses, and the government excluding the central bank), based on a simplified example adapted from Infante and others (2022) for the UAE context.[47] Table A3 below summarises the scenarios.

If the Digital Dirham replaces only physical cash, it would cause a redistribution of assets and liabilities on the balance sheets of both the CBUAE and households. According to Table A3, we assume that the "general public" allocates approximately AED 50 billion (equivalent to around 40% of the currency in circulation) to the Digital Dirham. This reallocation would not impact the central bank's balance sheet, as the Digital Dirham would simply replace physical cash. Domestic banks would not be affected, as the substitution is between cash and not deposits. While there would be a reshuffling of assets and liabilities within each balance sheet, the overall structure of the balance sheets for the public and the central bank would remain unchanged.

If the Digital Dirham primarily replaces bank deposits, it is expected to shrink the banking sector's balance sheet. Assuming that the "general public" decides to transfer AED 100 billion (approximately 5% of the money supply) to the Digital Dirham, bank deposits decline, resulting in a reduction of their reserves held with the central bank. This reduction will be at least equivalent to the required reserves linked to the withdrawn deposits. The potential consequences for banks could materialise in four ways: (1) banks may decrease their excess reserves, (2) they might seek central bank funding to compensate for the displaced deposits, (3) they could explore alternative funding sources from non-bank financial institutions, or (4) they may scale back lending activities to de-leverage:[48]

- *Decrease in Excess Reserves:* banks decrease their excess reserves at the central bank and

maintain their lending activities even with a decrease in deposits. This does not impact the overall size of the central bank and the general public's balance sheets, but it does cause a reduction in domestic banks' balance sheets. Banks aim to adhere to liquidity regulations, such as the LCR (and ELAR for smaller UAE banks), as outlined in Section 2.1 of the main text.

- *Increased Reliance on central bank Funding:* banks keep their balance sheet size stable by accessing funding from the central bank to compensate for a reduction in deposits. This scenario can occur when banks face challenges in obtaining sufficient loans from interbank markets or decide to maintain surplus reserves. In such instances, the balance sheets of banks and the general public stay the same, while the central bank's balance sheet grows as it offers liquidity to banks. Banks are inclined to choose central bank funding, as it is easier to access and more economical than non-deposit funding.
- *Increased Reliance on Non-Bank Funding:* banks may borrow from non-bank sources, such as the capital market or wholesale money markets, to sustain their lending activities. Shifting away from deposits to non-deposit funding is more likely if non-deposit funding costs are lower than accessing central bank funds. We assume that the CBUAE balances the issuance of Digital Dirham by accumulating additional assets, for instance, by increasing foreign reserves if banks seek foreign funding (which is subsequently converted by the CBUAE into AED). As a result, the balance sheets of the CBUAE and the general public increase while the balance sheet of the banking sector decreases by a smaller amount. This scenario is quite plausible given the limited market depth for non-deposit funding in the UAE in situations of low system-wide liquidity.
- *Reduction in Lending:* banks might react to decreased deposits by scaling back their lending operations. In this situation, the reduction in deposits is primarily seen in the form of decreased lending, which occurs gradually in absence of an alternative funding source. The central bank's balance sheet increases as the amount of Digital Dirham far exceeds the amount of required reserves for bank deposits it substitutes; individuals reduce their debt levels thanks to external funding (e.g., dividends, repatriation of foreign assets or foreign borrowing). This scenario is possible during times of declining economic activity but less likely in the near future, considering the robust real GDP growth in the UAE.

Table A3. Balance Sheet Impact of Introducing the Digital Dirham (AED billions)

			Disintermediation (Account Substitution)			
		Cash Substitution	Decline in Surplus Liquidity	Central Bank Funding	Alternative Funding	Bank De-leveraging
		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
	Pre-CBDC					
Central Bank (CBUAE)						
Assets	**720**					
- Domestic	25			+90		+90
- Foreign	695				+90	
Liabilities	**720**					
- Required Reserves	200		-10	-10	-10	-10
- Excess Reserves	130		-90			
- Currency in Circulation	135	-50				
- CBDC	**0**	**+50**	**+100**	**+100**	**+100**	**+100**
- Securities	215					
- Other	40					
Total	**720**	**720**	**720**	**810**	**810**	**810**
Balance Sheet Impact of CBDC		*Reallocation*	*Reallocation*	*Increase*	*Increase*	*Increase*
Banking Sector*						
Assets (Domestic)	**2,760**					
- Required Reserves***	200		-10	-10	-10	-10
- Excess Reserves	130		-90			
- Loans	1,740					-90
Liabilities (Domestic)**	**2,760**					
- Deposits	2,520		-100	-100	-100	-100
- Non-Deposit Funding	140			+90	+90	
- Other	100					
Total	**2,760**	**2,760**	**2,660**	**2,750**	**2,750**	**2,660**
Balance Sheet Impact of CBDC		*Unaffected*	*Decrease*	*Decrease*	*Decrease*	*Decrease*
General Public**						
Assets (selective & incomplete)	**2,655**					
- Deposits	2,520		-100	-100	-100	-100
- Currency in Circulation	135	-50				
- CBDC	0	+50	+100	+100	+100	+100
- Non-Bank Lending					+90	
Liabilities (selective & incomplete)	**1,740**					
- Loans	1,740					-90
- Other Liabilities	0				+90	
Other (net worth)	915					+90
Total	**2,655**	**2,655**	**2,655**	**2,655**	**2,745**	**2,655**
Balance Sheet Impact of CBDC		*Reallocation*	*Reallocation*	*Reallocation*	*Increase*	*Reallocation*

Sources: Infante and others (2022), authors. *Note:* numbers reported in the table are stylised for illustration purposes only (but broadly reflect actual values as of end-2023); we distinguish between five different scenarios: Scenario 1 (CBDC replaces cash), Scenario 2 (CBDC replaces deposits and banks reduce excess reserves to fund the outflow), Scenario 3 (CBDC replaces deposits and banks borrow from the central banks to fund the outflow), Scenario 4 (CBDC replaces deposits and banks borrow from (foreign) non-bank private sector to fund the outflow), and Scenario 5 (Banks reduce their lending/investment to offset decline in the deposit base); */ domestic activities only; **/ general public=households, businesses, and government (excluding the central bank) as well as non-bank financial institutions, ***/ reserve requirement averages to about 8% of the deposit base in the UAE - for simplicity, a ratio of 10% was applied; ****/ domestic liabilities amounted to AED 3,232 billion.

Annex 4. Overview of CBDC Distribution Models

There are three options for the operating model of a CBDC (Söderberg and others, 2022; Auer and Böhme, 2020): (1) *direct* or unilateral model: the central bank performs all payment functions, from issuing to distributing and interacting with end-users without involvement of the private sector; or (2) *indirect* models, which can be either *intermediated* (i.e., the central bank issues the CBDC as a direct claim on the central bank to end users, but the private sector is responsible for interacting with the end users) or *synthetic* (i.e., intermediaries issue digital money backed one-to-one by CBDC or national fiat currency).

In the *direct* model, the central bank issues the CBDC directly to the public, bypassing intermediaries. In this model, the central bank handles all aspects of onboarding, clearing, settlement, and communication with retail clients. One advantage of this approach is its simplicity, as holders of the CBDC know exactly what it represents. However, operationally, this model requires the central bank to dedicate significant resources to customer relationships, KYC, and due diligence on a scale not previously managed by central banks. Additionally, this approach may stifle innovation in payments technology, as the central bank would likely dominate the market with limited room for new developments.

In the *synthetic* model, consumer and merchant holdings of CBDC are not a direct claim on the central bank and resemble stablecoins. Instead, LFIs are required to fully back each customer's indirect CBDC claim with CBDC funds (or national fiat currency) held at the central bank. In this model, intermediaries handle all onboarding of clients and settlement of customer payments. The central bank only settles wholesale CBDC transactions between intermediaries, not too dissimilar to the role played by an RTGS. A benefit of this approach is that intermediaries maintain their current role with respect to managing customer relationships. However, a key drawback is the legal status of customer holdings of CBDCs. As they only represent a claim on the intermediary, they are like bank deposits, and, thus, require a robust regulatory and supervisory framework.

The CBUAE has chosen the *intermediated* approach for the Digital Dirham, where the CBDC is a direct claim on the central bank but with intermediaries handling distribution and customer relationships. This approach combines the benefits of digital central bank money with the involvement of the private sector in managing relationships, due diligence and KYC for millions of users.

The three operating models for CBDCs have varying implications for adoption rates. Involving the private sector in an indirect model is likely to lead to wider CBDC usage. While a direct model allows the central bank to offer payment functions to all, including the unbanked, it can be costly to build and operate the necessary technical infrastructure. The private sector, with its technical expertise, customer proximity, and risk management capabilities, is better suited for end-user interactions but requires stronger incentives to expand payment services.

Endnotes

1 In particular, the increasing popularity of crypto-assets and stablecoins as well as the decline in cash usage for payments could impact the future role of central banks and their ability to achieve their policy objectives.

2 Stablecoins have tried to mimic central bank money, but have often proved flawed, lacking the anchor of the trust in money provided by the central bank. Persistent uncertainty about the crypto ecosystem underscores that there is no substitute for access to central bank money and the foundation of trust it provides. Therefore, the CBUAE has recently issued its Payment Token Services Regulation (CBUAE, 2024a), which lays down the rules and conditions for granting a license or registration for the provision of payment token services and related matters.

3 In modern banking systems, there are two forms of money – central bank money and private sector money. central bank money represents a liability of the central bank. This includes physical cash in circulation, in addition to reserves held at the central bank by commercial banks and government institutions. In contrast, private sector money represents liabilities of commercial banks. This takes the form of digital deposits at regulated commercial banks. In a modern banking system, private money is created by commercial banks through lending. When banks extend loans, they simultaneously credit a customer's account with a matching deposit, thereby lengthening the bank's balance sheet. These deposits are then recycled across the banking system as consumers and businesses send money from one bank account to another to pay for goods and services in the economy. This creation of "private money" – which is commonly referred to as "fractional reserve banking" – not only places significant trust in the safety and soundness of banks but also requires that central banks guarantee the par value of payments in "private money".

4 A total of 134 countries representing 98 percent of the global economy are now exploring digital versions of their currencies (Atlantic Council, 2024).

5 Private cryptocurrencies, including stablecoins, have significant drawbacks compared to CBDCs. Cryptocurrencies lack key money characteristics: they are not a reliable store of value due to excessive volatility, not widely used as a medium of exchange, and not a unit of account. Stablecoins aim to address these issues by pegging their value to stable assets like fiat currency. However, they only partially solve problems and introduce new challenges. Stablecoins are often issued by private entities with unclear balance sheets, raising concerns about reserves and financial stability. Regulatory challenges persist as stablecoins are not widely accepted for payments and require on/off ramps, posing AML/CFT risks. In contrast, CBDCs, issued and regulated by central banks, offer a more stable and reliable option. They are designed to be a secure store of value, widely accepted for transactions, and a consistent unit of account. CBDCs benefit from central bank trust and regulation, making them a more promising digital currency option for the future.

6 Within the GCC, the CBUAE's development of the Digital Dirham is the most advanced CBDC project. Also the Saudi Central Bank has been making significant progress; the Central Banks in Kuwait, Oman and Qatar are still in the research stage (Park, 2024; Bouza and others, 2024).

7 A CBDC may be at a higher risk of cyber-attacks without adequate security measures and protections, potentially eroding trust in the financial system.

8 It should be fully interchangeable with other assets on the CBUAE balance sheet and with broader forms of money like bank deposits. This is necessary to ensure that the public can still access central bank money in a digital world and to limit any inconvenience to LFIs from its introduction.

9 A significant number of migrant workers do not meet the minimum salary requirements for accounts at banks, leading to a large unbanked population. Historically, they have relied on Licensed Exchange Houses (LEHs) for financial services. LEHs stand to gain by incorporating the innovative features of the Digital Dirham into their business strategies and operations.

10 The low adoption of CBDCs in some jurisdictions suggests a possible risk of similar challenges with the Digital Dirham.

11 Proper customer identification is crucial for the Digital Dirham's role in combating financial crimes. Connecting Digital Dirham wallets to verified Emirates IDs (EIDs) will help detect any violations of international and domestic financial sanctions and help mitigate associated risks to the integrity of the financial system.

12 Pseudonymity is defined in the CBUAE Rulebook, Section 3 (Section 3: Guidelines for Adopting Enabling Technologies - Distributed Ledger Technology (DLT).

13 Further analysis of privacy and financial crime is not considered within the scope of this paper, which is focused primarily on the macro-financial and monetary implications of introducing the Digital Dirham.

14 Note that benchmarking the UAE to other jurisdictions also needs to consider the specific characteristics of the UAE banking sector, including the large public sector ownership (directly and indirectly) as well as the absence of a deposit insurance scheme.

15 This model has firm theoretical foundations and was calibrated to match the characteristics of the UAE banking sector. The baseline structure of Gross and Letizia (2023) is more suited to study the adoption of CBDC conditional on different assumed remuneration rates; without remuneration, the differences between different types of money arise from assumed exogenous base utility. It does not explicitly consider other CBDC characteristics such as payment networks or holding or transaction limits as there is no granular segmentation of the non-banking sector, which are important policy considerations. Other model simplifications include static lending and no second-round macro-financial effects. Thus, the above results can be considered

as an estimate of equilibrium outcome (in normal times) with zero remuneration rate but without the holding limits.

16 Cash is assumed to have some inherent utility that keeps it circulating in any economy when banking services are available.

17 Bank of Canada (Li, 2021): 4% of M1; Bank of England (2021): 3% of deposits; Kingdom of Bahrain (IMF, 2023a): 4% of M3.

18 Based on the data as of December 2023, the excess structural reserves are sufficient to counteract the outflow of the deposits under the high adoption scenario. In their study on the development of CBDC initiatives in the MENA and Central Asia region, Bouza and others (2024) illustrate that non-interest-bearing CBDCs could constitute a significant portion of total money supply, particularly in economies heavily reliant on cash. If the transition primarily involves transactional balances, a CBDC could substitute for approximately half of circulating currency without significantly affecting the proportion of deposits. On average, the issuance of a CBDC could account for around 3.5% of total money supply (measured as M2), displacing 15% of the circulating currency (based on an average cash share of 20% of the total money in the countries examined). Countries with a high reliance on cash may observe a higher CBDC share, potentially reaching up to 10% of total money supply. For the UAE, where total currency in circulation represents about 6% of money supply, these findings suggest that the adoption rate of a CBDC falls within the range of empirical results mentioned earlier and that the risks of financial disintermediation are small.

19 The waterfall mechanism for the Digital Dirham involves a tiered system where funds are automatically transferred from a CBDC account to a linked bank account when the balance exceeds a certain threshold, ensuring liquidity and efficient fund management. Conversely, the reverse waterfall mechanism allows funds to flow from a bank account back into a CBDC account when the balance falls below a specified level, maintaining a minimum balance in the CBDC account. These mechanisms facilitate seamless integration between traditional banking and digital currency systems, enhancing user convenience and financial stability.

20 Monetary policy transmission operates through the following channels: interest rates, lending rates, asset prices/wealth, and the exchange rate. Monetary transmission through the interest rate channel occurs when the change in the policy rate affects the overall level of interest rates in the economy, and, thus, affects the financing conditions underpinning aggregate demand (consumption and investment) by changing the marginal cost of borrowing. Under the lending channel, changes in the policy rate and its expectation affect banks' balance sheets (and creditworthiness), causing them to adjust lending rates and standards, which impacts the availability of credit. Policy rates also affect asset prices in the economy, which determines the balance sheet quality of borrowers by changing their net worth, and, thus, their creditworthiness and costs of borrowing (asset price/wealth channel). Finally, under the exchange rate channel, the effect of higher (lower) policy rates on the exchange rate could lead to capital inflows (outflows) and, in the short run, before prices adjust, a real appreciation (depreciation) of the currency and an expansion (contraction) of net exports. An appreciated (depreciated) rate leads to a positive (negative) wealth shock and looser financial conditions, boosting consumption and counteracting the trade channel.

21 However, if banks accept lower profits to attract "costlier" deposits, they are more inclined to raise interest rates when the policy rate is increased—thus strengthening transmission. The opposite is likely to occur when the policy rate declines, even though the effect is likely to be small.

22 The Digital Dirham could widen access to interest-sensitive borrowing and saving instruments—for instance, if (1) payments data related to Digital Dirham transactions is used to build financial histories, which widens credit access among the unbanked, and/or (2) the Digital Dirham serves as an entry point to a digital financial account, which ultimately leads to the opening of bank accounts (Söderberg and others, 2023). In this case, financial inclusion implies that more households would be sensitive to the monetary policy stance.

23 The adoption of Digital Dirham could stimulate financial innovation, which has historically increased the velocity of money (Anderson and others, 2016).

24 Real interest rates and real money demand are the deflated monetary measures to appropriately characterise the impact of the Digital Dirham on liquidity conditions.

25 This option would be preferable to creating new types of credit operations, which would take additional time and might introduce new sources of risk. However, the adoption of the Digital Dirham will not impact the current range of structural and fine-tuning open market operations.

26 The issuance and circulation of a Digital Dirham introduces a new autonomous factor on the CBUAE balance sheet, which requires amending the current forecasting framework. The forecasting approach combines all known cash flows from market operations with model-driven forecasts of the autonomous factors to determine the expected liquidity surplus each day. Autonomous factors consist of CBUAE's balance sheet items that are outside its control (such as net foreign assets, currency issued, state account and other accounts at the CBUAE). Monetary operations cover items that are within the control of the CBUAE (such M-Bills issuance and usage of liquidity facilities). If the sum of the changes in the autonomous factors and monetary operations is positive, banks' reserves with the CBUAE increase (i.e., the monetary impulse is positive) and vice-versa.

27 However, if the Digital Dirham is held in large quantities abroad, changes in external demand could cause significant fluctuations in the CBUAE's balance sheet due to capital flows, which impacts reserve management and could complicate monetary operations (He and McCauley, 2010).

28 Given the CBUAE's small size of local exposure, the corresponding increase in reserve assets will be invested mostly in external USD-denominated assets, and, thus, will not have any price effects on the domestic yield curve.

29 Bindseil (2016) argues that a large balance sheet increases seigniorage; however, Hall and Reis (2015) point to the risks (interest rate, foreign exchange, and default) from a larger balance sheet, which results in higher leverage.

30 This approach aligns with similar CBDC projects in the region, where private sector involvement in interacting with end users is preferred.

31 As part of a general review of the Digital Dirham after its introduction, certain policy choices might be revisited after a comprehensive impact analysis.

32 If an individual holds multiple CBDC accounts, the limit will be applied collectively rather than individually.

33 Despite ongoing discussions, there is no universally agreed-upon legal definition of CBDC (Bossu and others, 2020).

34 Lawyers specialising in central banking, monetary law, payment systems, and financial law should be involved in designing CBDCs to ensure legal certainty, accountability, and transparency in the central bank's role (Söderberg and others, 2023).

35 The legal categorisation of CBDC has important consequences in private law, especially in transactions involving individuals and entities using CBDC. One potential area for legislative changes is the extension of legal safeguards against counterfeiting physical banknotes and coins to include the Digital Dirham. Currently, no jurisdiction has made specific amendments to its criminal laws to address CBDCs, and such changes may not be needed at this time.

36 During Phase 1 of implementation, the CBUAE completed a legal gap analysis and enacted amendments to central bank Law to issue the Digital Dirham as legal tender, the CBUAE also approved 28 CBDC-specific policy decisions to maintain monetary and financial stability, promote financial inclusion and counter financial crime.

37 The Project mBridge, a collaboration between the Hong Kong Monetary Authority, the Bank of Thailand, the Digital Currency Institute of the People's Bank of China, and the Bank for International Settlements, has played a crucial role in the development of the Digital Dirham. In 2022, the CBUAE conducted pilots of significant cross-border CBDC transactions totalling over US$22 million. Project mBridge focuses on exploring a multi-CBDC common platform for wholesale cross-border payments to address issues such as high costs, slow processing times, lack of transparency, and operational complexities. The project also prioritises maintaining currency sovereignty and ensuring monetary and financial stability for each participating jurisdiction, following the principles of "do no harm," compliance, and interoperability. Supported by custom-built distributed ledger technology (DLT), a comprehensive legal rulebook, and a suitable governance structure, Project mBridge aims to enhance cross-border payment efficiency (BIS, 2022 and 2023).

38 In January 2024, His Highness Sheikh Mansour bin Zayed Al Nahyan, Chairman of the CBUAE, initiated the first issuance of the Digital Dirham on the issuance platform as legal tender and authorised the first cross-border payment of AED50 million in Digital Dirham to P.R. China as the first live MVP payment on the Project mBridge platform.

39 See Bank of Indonesia (2024) for a recent example of a central bank pilot of a wholesale CBDC in an emerging market context.

40 See Bear and others (2024) for an interesting review and policy discussion of different approaches for the design and implementation of wholesale CBDCs.

41 Private money refers to any form of currency or financial instrument that is issued by a private entity rather than the central bank or government, including deposits, digital currencies, and other financial instruments or tokens used as a medium of exchange within a private network or community. Private money operates alongside or in place of government-issued currency and is typically used within specific contexts or communities.

42 Primarily due to the correspondent banking model's various factors like multiple intermediaries, varying operational hours, and limited corridors.

43 This shift in consumer behaviour could impact banks' net interest incomes. CBDCs also have the potential to provide a more cost-effective and efficient option for cross-border remittances, which may reduce earnings from payment and foreign exchange transactions in the financial industry.

44 Hemingway (2024) shows – based on a theoretical cash credit model for the UK – that there are positive welfare gains from introducing an unremunerated retail CBDC, but these have likely declined over time.

45 Various studies also explore how CBDCs might affect the transmission of monetary policy (Agur and others, 2022; Mancini-Griffoli and others, 2018).

46 Much of the existing literature relies on theoretical models, raising questions about how well findings translate to real-world scenarios with incremental CBDC adoption and specific design features (Bindseil and Senner, 2024b).

47 The data is based on the current composition of the CBUAE's balance sheet (in billions of Dirhams). The external sector is not included as the use of the Digital Dirham for international trade for simplicity. Non-bank financial institutions are categorised as part of the "general public" for the purpose of this presentation. The elements of each balance sheet are kept broad to avoid unnecessary detail. For example, the issuance of the Digital Dirham will impact not only currency in circulation but also the composition of the CBUAE's current account.

48 We assume an adoption rate of 5%.