In-Class Exercise: CBDC Architectures & Cross-Border Interoperability

Exercise 1: Debate — "Direct vs. Two-Tier vs. Synthetic CBDC: Which Intermediation Model Should a Central Bank Pick?"

Format: Split the class into three teams. Each team prepares arguments for its assigned architecture model. After presentations, the class holds a structured vote with a debrief.

Team A — Direct CBDC (central bank issues & operates citizen accounts directly)

Anchoring evidence: Under a Direct CBDC, every citizen holds an account at the central bank. There is no commercial-bank intermediary in the payment path. The central bank controls onboarding, KYC, and the ledger. This maximises monetary-policy pass-through and eliminates intermediary rent. Nigeria's eNaira and the Bahamas Sand Dollar approximate this model.

	Team A: Direct CBDC
Argument I	
Argument II	
Argument III	
Concession	*Strongest argument AGAINST Direct CBDC:*
Closing	*How you address the concession:*

Team B — Two-Tier CBDC (central bank issues; commercial banks distribute)

Anchoring evidence: The Two-Tier model keeps commercial banks as intermediaries. The central bank mints CBDC and distributes wholesale to licensed PSPs, who run the retail wallets. The EU digital euro and China's e-CNY "designated operator" structure both approximate Two-Tier logic. Banks retain deposit relationships and KYC infrastructure.

	Team B: Two-Tier CBDC
Argument I	
Argument II	
Argument III	
Concession	*Strongest argument AGAINST Two-Tier CBDC:*
Closing	*How you address the concession:*

Team C — Synthetic CBDC (fully-backed stablecoins issued by regulated private entities)

Anchoring evidence: Under a Synthetic CBDC, the central bank does not issue a consumer token at all. Instead, licensed private issuers (banks, PSPs, big tech) issue fully-backed stablecoins,

holding 100% reserves at the central bank. USDC and EUROE approximate this model. Singapore's MAS Project Ubin explored Synthetic architecture as a way to allow private innovation without direct CB retail exposure.

	Team C: Synthetic CBDC
Argument I	
Argument II	
Argument III	
Concession	*Strongest argument AGAINST Synthetic CBDC:*
Closing	*How you address the concession:*

Debrief Questions

Q1: How does bank-run risk differ across the three architectures? Which model makes a systemic crisis most likely, and which makes it least likely?

Q2: Which architecture minimises disintermediation of commercial banks? Does that also mean it minimises financial inclusion gains?

Q3: If a neighbour country adopts a different architecture from your own, what cross-border spillovers arise? Consider exchange-rate pressure, regulatory arbitrage, capital flows, and geopolitical alignment.

Exercise 2: Cross-Border CBDC Interoperability Case Study (mBridge & Agorá)

Scenario: Two major wholesale CBDC interoperability initiatives are underway. **mBridge** (launched by HKMA + BIS Innovation Hub + Bank of Thailand + UAE Central Bank + PBoC) is a shared multi-CBDC platform that settles cross-border payments on a common distributed ledger. **Agorá** is a BIS-coordinated project involving seven central banks (Federal Reserve, ECB, Bank of England, Bank of Japan, Bank of Korea, Bank of Mexico, and SNB) exploring how tokenised commercial bank deposits and wholesale CBDC can be integrated on a unified ledger to improve cross-border settlement. Both initiatives target the same pain point — the slow, expensive correspondent-banking system — but with different architectures and geopolitical compositions.

Table 1 — Corridor Economics (fill in the empty cells)

Corridor	Current corr.-banking cost	CBDC-path cost (est.)	Settlement-time delta	Liquidity requirement delta
HKD ↔ THB				
HKD ↔ AED				
USD ↔ JPY				
CHF ↔ EUR				
GBP ↔ KRW				

Table 2 — Interoperability Architecture Comparison (fill in the empty cells)

Initiative	Ledger type (shared vs. linked)	Central-bank role	Settlement finality	Regulatory perimeter
mBridge				
Agorá				
Project Nexus				
SWIFT				

Table 3 — Geopolitical Stakes (fill in the empty cells)

Actor	What it gains from each architecture	What it risks from each architecture
USA		
China		
EU		

Synthesis Question

If you were the SNB Governor, would you join mBridge, Agorá, both, or neither? Defend your choice with three reasons, addressing corridor economics, geopolitical alignment, and the implications for Swiss monetary sovereignty.

Your answer:

Facilitator Solutions

Sample answers for instructor reference. These are illustrative; student reasoning may diverge and still be valid.

Exercise 1: Architecture Debate Sample Answers

Team A (Direct CBDC) — sample arguments

Argument I. Direct CBDC gives the central bank exact control over the monetary transmission mechanism. When the CB sets policy rates or distributes helicopter money, the effect reaches citizen wallets immediately with no bank-margin attenuation or credit-creation side effects. For monetary-policy efficacy, this is the theoretically purest architecture.

Argument II. Universal access is guaranteed by design. No commercial bank can deny an account, add fees, or require a credit check. For financially excluded populations — migrant workers, rural residents, informal-economy participants — the Direct model removes the gatekeeper problem at its root.

Argument III. Eliminating intermediary rent permanently reduces payment-system costs. Commercial banks earn spread on float, interchange fees on card rails, and FX margins on cross-border payments. A Direct CBDC compresses all of these. The long-run social saving is substantial.

Concession. The central bank becomes a retail service provider for hundreds of millions of wallets. That requires CB operational capacity — call centres, fraud teams, app development — that no central bank is built for. The disintermediation of commercial banks also removes the credit-creation function that drives investment and growth.

Closing. Central banks can outsource operations to licensed agents (as eNaira does) without giving up ultimate account control. The credit-creation concern is addressed by holding limits: a CHF 3,000 cap on CBDC holdings constrains disintermediation while preserving universal access.

Team B (Two-Tier CBDC) — sample arguments

Argument I. Commercial banks have spent decades building KYC, AML, and credit-risk infrastructure. Two-Tier CBDC reuses this investment rather than duplicating it at the central bank. Regulatory compliance is therefore faster to achieve and cheaper to maintain. The EU digital euro proposal explicitly adopts Two-Tier for exactly this reason.

Argument II. Banks remain deposit-funded intermediaries, preserving fractional-reserve credit creation. The macroeconomic stability argument is strong: removing banks from the intermediation chain in a Direct model could shrink the credit supply dramatically, raising lending rates and slowing investment.

Argument III. Two-Tier is politically viable in mature banking systems. Regulators, banks, and legislators can co-design the architecture without threatening the financial system. Direct CBDC requires dismantling relationships and regulatory frameworks that have been built over a century; Two-Tier does not.

Concession. Two-Tier CBDC preserves the gatekeeper role of commercial banks. The unbanked remain dependent on bank willingness to onboard them. If a bank refuses a customer, the financial-inclusion promise is unfulfilled. The intermediary layer also reintroduces the very costs CBDC was designed to eliminate.

Closing. Regulatory mandates — non-discrimination rules, PSP licence conditions — can force banks to accept all comers. Holding limits and fee caps address cost concerns. The financial stability gain from preserving credit creation outweighs the residual inclusion imperfection.

Team C (Synthetic CBDC) — sample arguments

Argument I. The central bank avoids technology concentration risk. A CB running retail-money infrastructure is a single point of failure for national payments. By letting regulated private issuers (banks, PSPs, qualified tech firms) issue fully-backed stablecoins, the market distributes resilience. USDC has operated without a major failure for years; EUROE is live in the eurozone.

Argument II. Market competition drives innovation. Under Synthetic CBDC, issuers compete on features, fees, and user experience. Under Direct or Two-Tier, innovation is constrained by central bank procurement and political cycles. The consumer wins from faster product iteration — a dynamic that centrally-run CBDC systems cannot replicate.

Argument III. Synthetic CBDC is already operational practice in many jurisdictions. Regulating and backstopping it is more tractable than building a new CB infrastructure. USDC issuers (Circle) hold 100% reserves at the Fed; the SNB could adopt the same model for CHF stablecoins tomorrow, without a multi-year CB digital-infrastructure programme.

Concession. The central bank cannot guarantee stablecoin issuers will not fail. Counterparty risk at the issuer layer reintroduces exactly the bank-run risk that direct CB issuance was supposed to eliminate. Silicon Valley Bank's role as a Circle reserve custodian in March 2023 demonstrated this fragility in real time.

Closing. Full reserve requirements at the CB, combined with resolution regimes for issuers, can contain counterparty risk. The residual risk is smaller than the aggregate systemic risk created by concentrating all national retail payments in a single CB-run infrastructure.

Debrief Q1 — Bank-Run Risk Profile

Direct CBDC has the highest bank-run amplification. In a stress event, depositors can shift funds from commercial bank accounts to the CB-backed CBDC in seconds, bypassing the queue at the ATM. The digital run dynamic is faster and larger than any historic cash-withdrawal bank run. Holding limits (e.g., EUR 3,000 per wallet) are the primary mitigation, but they directly limit inclusion — the central tension of the Direct model.

Two-Tier CBDC has medium run risk. Commercial banks act as a buffer: they distribute CBDC but continue to intermediate credit. A bank-run into CBDC triggers CB-to-bank settlement flows that the CB can manage via emergency liquidity operations. The two-tier buffer slows the run velocity.

Synthetic CBDC has the lowest systemic run risk to the monetary base — a run targets the issuer (a private firm), not the monetary base itself. However, issuer failure creates a stablecoin de-peg event (as TerraUSD demonstrated in 2022), which is a different systemic risk: a payments-system seizure rather than a bank-run.

Debrief Q2 — Disintermediation vs. Inclusion Trade-off

Two-Tier minimises bank disintermediation because commercial banks remain in the payment path. But that preservation comes at a cost: it also preserves the banks' gatekeeping power over account access. The financial-inclusion gain is therefore partial — it depends on bank willingness to serve previously unbanked customers under CB mandate or competitive pressure. Direct CBDC maximises inclusion by removing the gatekeeper, but maximises disintermediation. Synthetic CBDC is ambiguous: inclusion depends on whether issuers choose to serve thin-margin customers, and disintermediation depends on whether banks are among the licensed issuers.

Debrief Q3 — Cross-Border Spillovers from Architecture Divergence

When two neighbouring countries adopt different CBDC architectures, four spillover channels activate:

1. **Exchange-rate pressure:** A Direct CBDC neighbour offering negative nominal rates creates capital-flow pressure into the Two-Tier country, where rate transmission is slower.
2. **Regulatory arbitrage:** If Synthetic CBDC allows broader issuer competition, issuers will incorporate in that jurisdiction and serve cross-border customers from there, hollowing out the regulatory perimeter of the Two-Tier neighbour.
3. **Capital flow changes:** CBDC corridors between architecturally compatible countries become frictionless; others remain on correspondent-banking rails, creating a two-speed cross-border payment system.
4. **Geopolitical alignment:** Architecture choice signals bloc membership. Joining mBridge signals BIS-Asia-Gulf alignment; joining Agorá signals USD-EUR-GBP-JPY bloc alignment. Countries in between face an architecture choice that is simultaneously a geopolitical choice.

Exercise 2: Cross-Border Case Study Sample Answers

Table 1 — Corridor Economics (illustrative values)

Corridor	Current cost	CBDC-path cost	Settlement delta	Liquidity delta
HKD ↔ THB	∼12–18 bps, 1–3 days	∼2–3 bps, seconds	−2.9 days	−30–50% pre-fund
HKD ↔ AED	∼10–15 bps, 1–2 days	∼2 bps, seconds	−1.9 days	−25–40% pre-fund
USD ↔ JPY	∼5–8 bps, T+1 via CHIPS	∼1 bp, intraday	−1 day	−15–20% pre-fund
CHF ↔ EUR	∼3–5 bps, T+1 (SEPA/SIC)	∼0.5 bp, intraday	−0.9 days	−10–15% pre-fund
GBP ↔ KRW	∼20–30 bps, 2–4 days	∼3 bps, seconds	−3.5 days	−40–60% pre-fund

Instructor note: The CHF/EUR corridor already has one of the lowest correspondent-banking costs globally due to SIC–TARGET2 linkage. The marginal gain from CBDC is therefore smallest there. The HKD/AED and GBP/KRW corridors show the largest absolute improvement because both rely on multi-hop correspondent chains.

Table 2 — Interoperability Architecture Comparison

Initiative	Ledger type	CB role	Settlement finality	Regulatory perimeter
mBridge	Shared multi-CBDC distributed ledger (permissioned DLT)	Each CB issues own CBDC on the shared platform; BIS hosts	Atomic, real-time, instant cross-border DVP	Fragmented: each jurisdiction's own rules; BIS sets platform rules
Agorá	Unified tokenised ledger (commercial deposits + wholesale CBDC)	7 CBs as wholesale CBDC issuers; private banks tokenise deposits	Intraday, near-final on unified ledger	Aligned: participating jurisdictions harmonise rules jointly
Project Nexus	Linked (API bridge between domestic instant-payment systems)	None on ledger; CBs provide oversight only	Depends on underlying systems (T+seconds)	National, with BIS-designed API standards
SWIFT	Messaging only (correspondent banking underneath)	None	T+1 to T+4 (settlement by correspondent)	National, bilateral, fragmented

Table 3 — Geopolitical Stakes

Actor	Gains	Risks
USA	Agorá extends USD bloc dominance into tokenised settlement rails; dollar primacy in wholesale CBDC mirrors its SWIFT primacy. Synthetic CBDC model (USDC) allows private-sector innovation without displacing the Fed.	If mBridge gains wide adoption, USD correspondent-banking revenues erode. A digital dollar that is slow to launch cedes first-mover advantage to e-CNY in emerging-market corridors.
China	mBridge creates a parallel wholesale settlement layer outside SWIFT, enabling PBoC to settle with Gulf and ASEAN partners without USD intermediation. e-CNY internationalisation advances alongside mBridge corridor growth.	Western nations may restrict mBridge participation, limiting network to non-G7 corridors. Two-tier architecture must be maintained to avoid direct disintermediation of Chinese commercial banks (ICBC, CCB).
EU	Agorá membership preserves EUR's role in tokenised wholesale settlement alongside USD and GBP. Digital euro (Two-Tier) can be onboarded to Agorá rails.	If digital euro is delayed, EUR is absent from first-generation tokenised settlement infrastructure. Member states with strong privacy laws (Germany) may resist wholesale-ledger data-sharing with non-EU CBs on Agorá.

Synthesis Question — SNB Governor Perspective

A well-reasoned answer recommends joining **Agorá** while monitoring mBridge, for three reasons:

1. **Corridor economics.** The CHF/EUR corridor is Switzerland's largest by volume. Agorá directly optimises this corridor by aligning SNB with the ECB on a shared tokenised ledger. The marginal gain over the already-efficient SIC–TARGET2 link is modest in bps terms, but

the structural gain — removing correspondent-bank intermediation entirely for wholesale transactions — is permanent.

2. **Geopolitical alignment.** Agorá's membership (FED, ECB, BoE, BoJ, BoK, BoM, SNB) matches Switzerland's primary trading and investment partners. Joining mBridge would signal a geopolitical pivot inconsistent with Swiss neutrality doctrine and would risk secondary-sanctions exposure under US and EU financial regulation.

3. **Helvetia continuity.** The SNB has already run Project Helvetia (wholesale CBDC on the SIX Digital Exchange platform). Agorá's architecture is more compatible with the Helvetia tokenised-securities settlement model than mBridge's shared DLT. Joining Agorá extends existing Swiss infrastructure investment; joining mBridge would require a parallel and potentially conflicting infrastructure build.

Full credit for any answer that correctly applies all three analytical dimensions (economics, geopolitics, existing infrastructure) and reaches a defensible conclusion with explicit reasoning. Partial credit for answers that address two of the three dimensions.