PROJECT MARIANA
CBC & AMMS

Can Traditional Finance stabilize Decentralized Finance

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MASTER'S IN QUANTITATIVE ECONOMICS - DIGITAL ECONOMICS TRACK SOLIDITY AND SMART CONTRACT DEVELOPMENT

WHY SHOULD WE USE DLT IN FOREIGN EXCHANGE

Commercial banks rely on vomplex foreign exchange infrastructure that entails friction in payment between two institutions

Central banks play a tethering role, with large-value payment systems, like Fedwire in the U.S. or TARGET2 in Europe, facilitate these operations

Financial transfer arrangements may fail, as the current system only covers a set of 18 currencies and carries settlement risk, the risk that one party fails to deliver the currency owed.

WHY DO WE NEED CENTRAL BANK ON THE BLOCKCHAIN

Facilitates cross-border payment with smart contract between financial institutions

Central banks issue trustworthy tokens to anchor cross-border FX transfers to real value.

MARIANA PROJECT

Proof of Concept (PoC) conducted between the French, Swiss, and Singaporean central banks and the Bank of International Settlements (BIS) to explore cross-border FX settlement using wCBDCs and AMMs.

Issuance of Central bank Digital Currency, only for commercial banks (wCBDC) to ensure Foreign Exchange between actors within their respectives currency areas.

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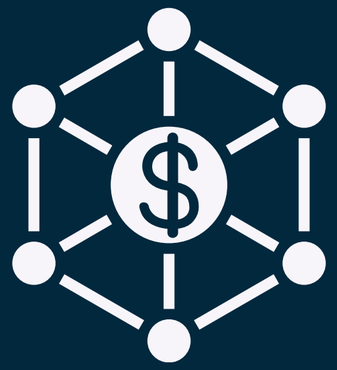
Rationale and Tokenized instruments



Technical architectures

Automated Market Makers

Outcomes

WHAT CHALLENGES LIES IN FX ?

Fragmented Markets

Cross-Border Payments

Cross-Border Payments

Limited accessibility

Low Transparency

Two types of transfers settlement:

Payment versus Payment

The settlement of one currency occurs only if the other is settled simultaneously

Delivery versus Payment (DvP)

The transfer of an asset occurs only upon payment.

HOW WOULD CENTRAL BANKS SECURE DLT TECHNOLOGIES

- On DLT, the central bank's tethering role becomes crucial because smart contracts require both currencies to be available simultaneously for settlement.
- Without the central bank ensuring liquidity and trust, smart contracts cannot guarantee safe, simultaneous execution, potentially reintroducing settlement risk.
- **Goal of the central banks:** introduce central bank money (CBM) on DLT, issuing tokens that can be accessed and transacted via smart contracts.

Retail CBDC (rCBDC)

Designed for general use by the public, enabling payments and transactions at the retail level.

WholeSale CBDC (wCBDC)

Equivalent to electronic bank reserves, intended for use by financial institutions for interbank settlements and large-scale transactions

WCBDC IN DETAILS

Each central bank is the sole issuer of its currency

Implemented with smart contracts following established standards like ERC20

Central banks grants access to commercial banks with differentiated eligibility rules

Central Bank can block or revoke access, recover wCBDCs from banks if needed, and monitor all transactions

WCBDC  StableCoins

TECHNICAL ARCHITECTURE TO PROVIDE CBDC

Distributed DLT architecture:

Central Banks issue CeBM on their own Distributed Ledger Technology (DLT)infrastructure, where participants can acquire the official wCBDC

One DLT can be connected to other DLTs, both cash and securities, and used for DvP or PvP

wCBDC and tokenised assets circulate on separate DLTs, but representative wCBDC tokens are issued on a shared DLT

Transfers effectuated by bridges: set of two smart contracts, one for the domestic platform (domestic bridge smart contract) and one for the transnational network

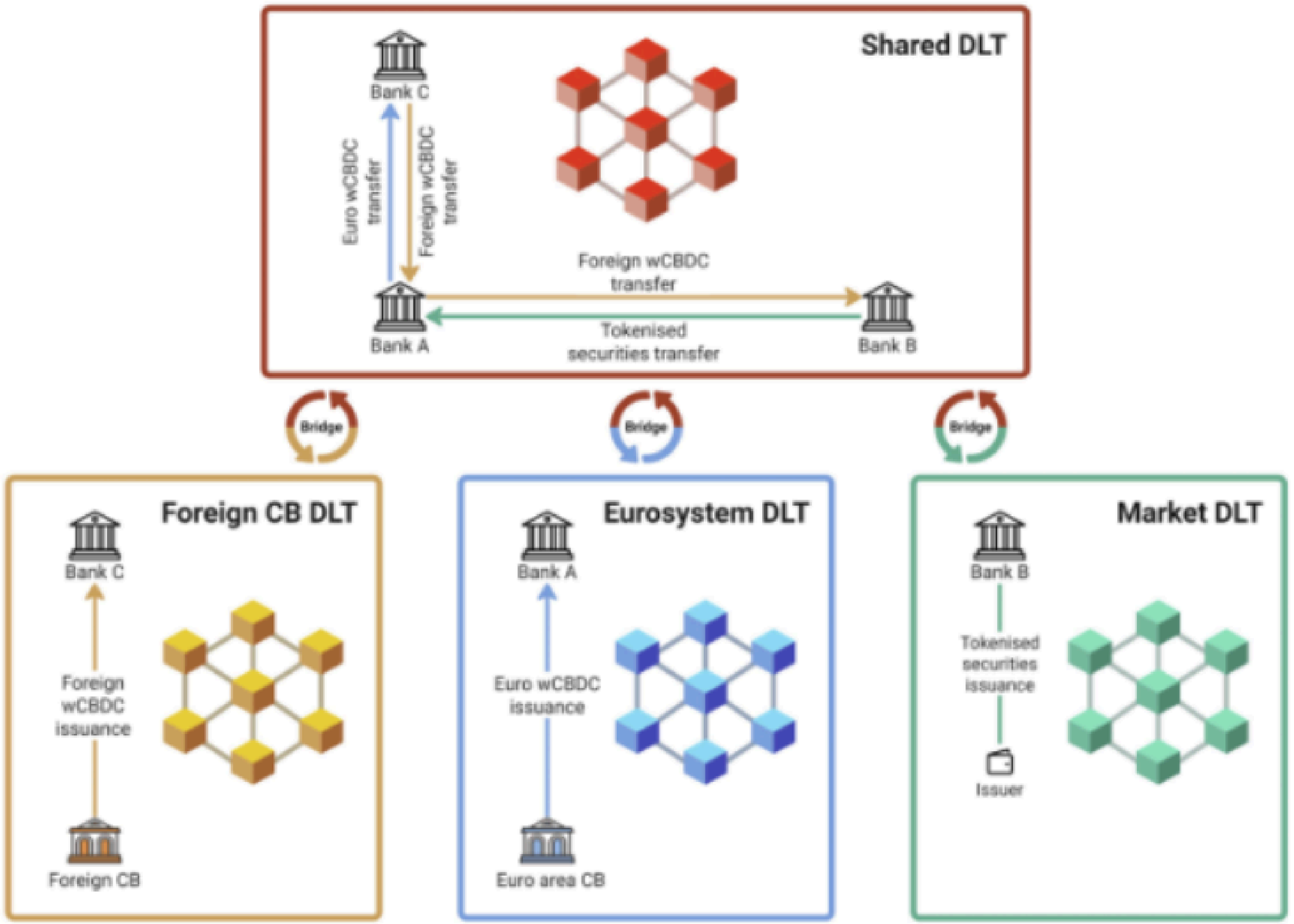


FIGURE 5 – Distribution model

SPECIFITY OF MARIANA

Relayers bridges

- Relayers (smart contracts ensuring transactions between national and transnational network) are hosted off-chain (on central bank servers or in the cloud).
- Consensus mechanism among relayers: Multiple relayers needed to confirm a transaction before further processing.
- Six relayers were implemented per bridge, where three were dedicated to each direction.

Whitelisting

Controls implemented during the experiments via smart contracts

Standardisation

Derived from ERC20, with additions for whitelisting

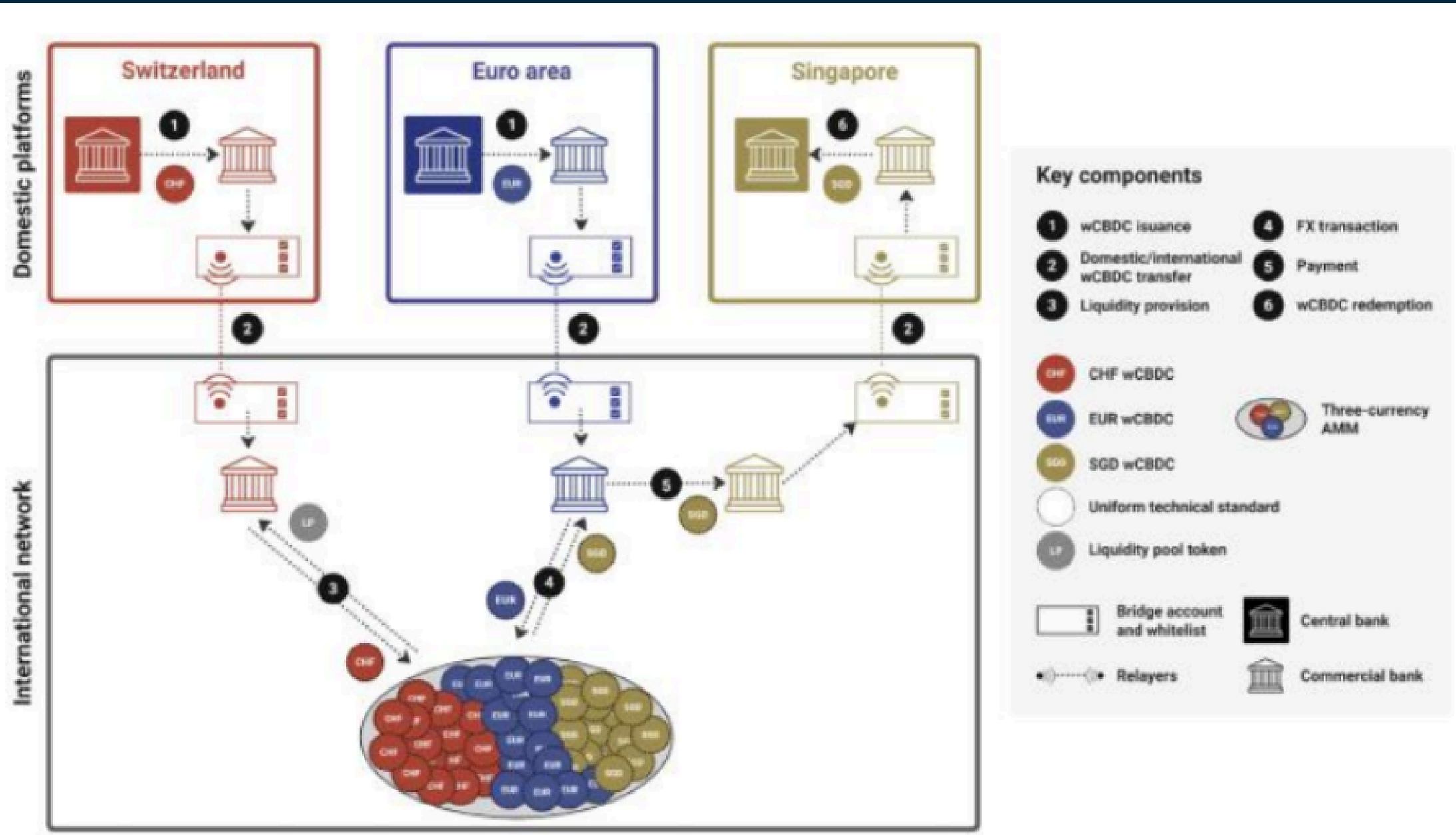


FIGURE 6 – Illustration of a PvP in Project Mariana (Source: BIS)

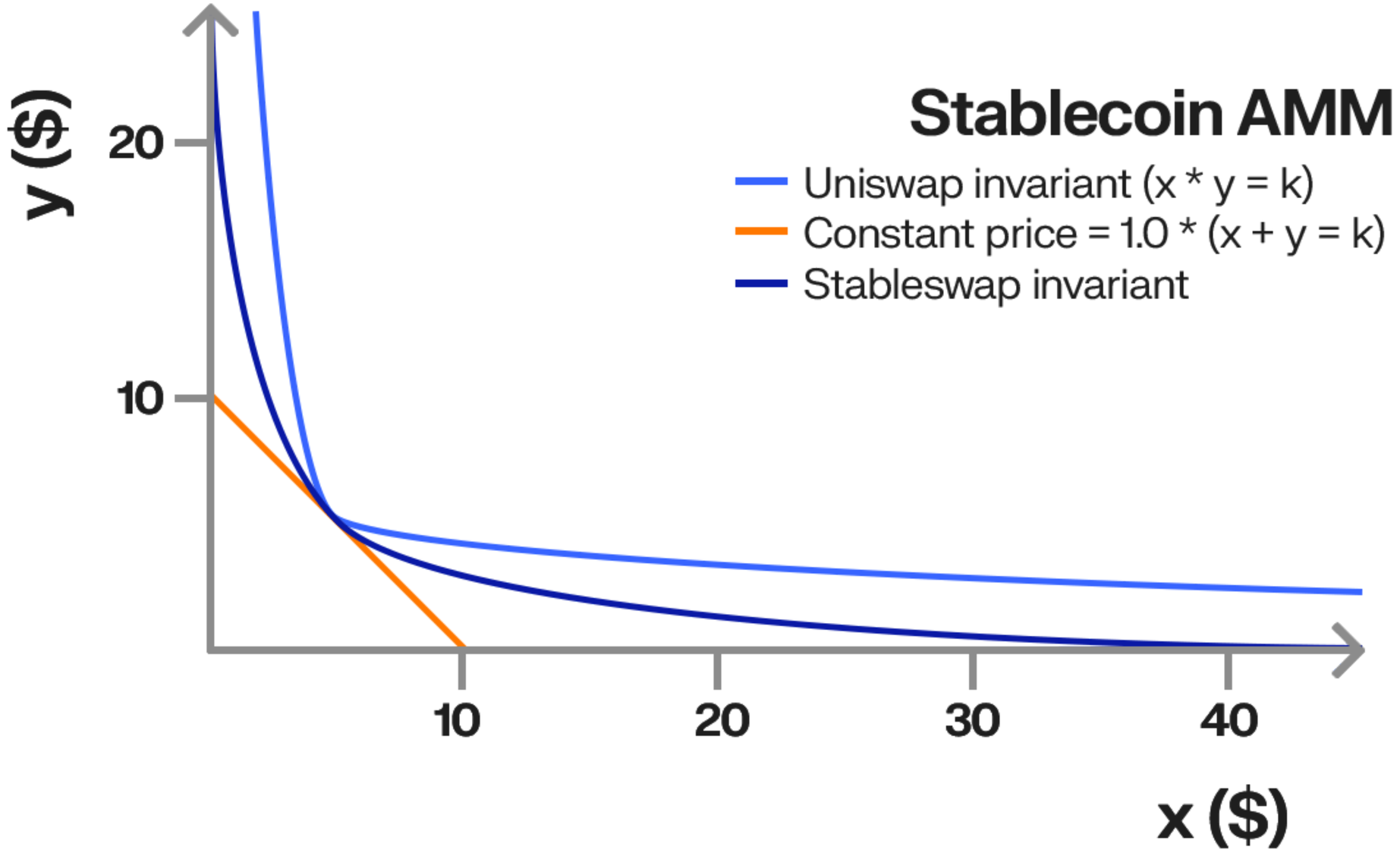
ONE SOLUTION: AUTOMATED MARKET MAKERS (AMMS)

- AMMs are an important component of cryptocurrency exchange platforms.
- The trading and settlement are done almost instantaneously. The process relies on a succession of smart contracts, that need no manual intervention. Transactions can thus be done 24/7.
- Prefunded transactions, so the settlement risk is eliminated.

PARAMETERS

- AMMs for regular institutions have to respect a lot more regulations than crypto AMMs.

- Project Mariana is based on a Hybrid Function Market Maker (HFMM), more complex than Constant Sum MM or Constant Product MM. It is more suited for stable tokens.



SOURCE: KEYROCK, "WHAT IS A LIQUIDITY POOL"

SPECIFICITIES OF THIS AMM

- **<u>Atomic settlement:</u> With smart contracts, the trading will only happen if both parties already have the funds needed.**
- **Either both parties pay, or none pays. The trading and settlement must happen at the same time.**

SPECIFICITIES OF THIS AMM

- **Repegging: when the “real-life” exchange rate shifts, the AMM will recenter its curve to fit the new prices**

- **Certain conditions need to be met for the repegging to happen. The goal is to ensure the liquidity providers (commercial banks) do not suffer from the shift.**

OUTCOMES

Three outcomes identified by BIS report

Overall success, as FX trading and settlement can be contained within a single step as a result of combining wCBDCs with AMM

Need for intermediaries in trading can be overcome through the application of a transnational network, while central banks' issuance and management of wCBDCs is retained.

Enabled the trading of a three-token pool against the AMM.

CONCLUSION

- A platform that provides 24/7 liquidity and automated pricing (pegged to the market) is possible.
- The prefunding aspect, that solves the settlement risk issue, would lead to banks rethinking the management of their daily liquidity
- There are legal and security requirements for a real-life, large-scale implementations of that process.

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