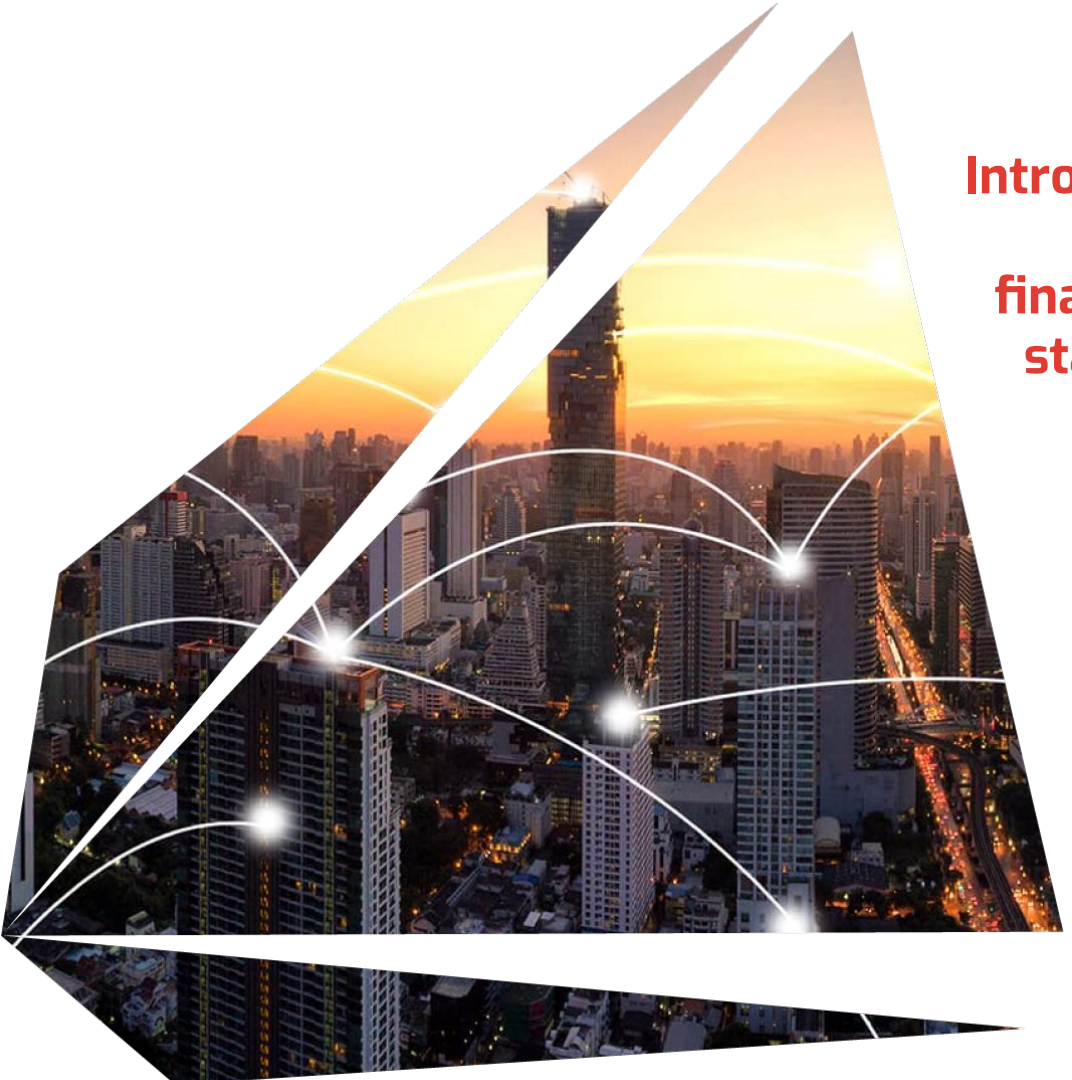


Introduction of central bank digital currencies and its impact on financial intermediation, financial stability and the macroeconomy

MNB - OMFIF
Financial Stability Conference

Dr. Kimmo Soramäki
Founder & CEO, FNA

26-27 May 2022, Budapest

FNA

What CBDCs (or projects) do exist?

	Domestic	Cross-Border
Retail	• eNaira (Nigeria) • Sand Dollar (Bahamas) • DXCDCaribe (ECCB) • Several other projects	• Celo (Crypto) • Arf (Stablecoin)
Wholesale	• ?	• Project Jura • Bilateral links (HSBC-IBM) • cBDCs* (Fnality, RTGS.global, Baton, SETL, Partior)

*cBDC - Commercial Bank Digital Currency

What problems are CBDCs solving?

	Domestic	Cross-Border
Retail	• Cost of cash & loss of Seigniorage • Financial inclusion • Sovereignty & Security • Anonymity online • Government spending • New use cases	• Soft-power • Seigniorage • Foreign aid
Wholesale	• ?	• Liquidity • Operational Efficiency • Speed

What are they competing with/replacing?

	Domestic	Cross-Border
Retail	• Cash • Cards • Fintech • Mobile .	• Cash • Cards • Fintech • Crypto/Stablecoins • Money Transmitters
Wholesale	• RTGS • Faster Payments • ACH • Direct debits	• Correspondent Banking

How do we design a retail CBDC?

Should CBDC wallets have caps?

Is there a limit on payment values?

Can person-to-person payments be made? How about B2B?

Does the CBDC cycle freely, or needs to return to CB sometimes?

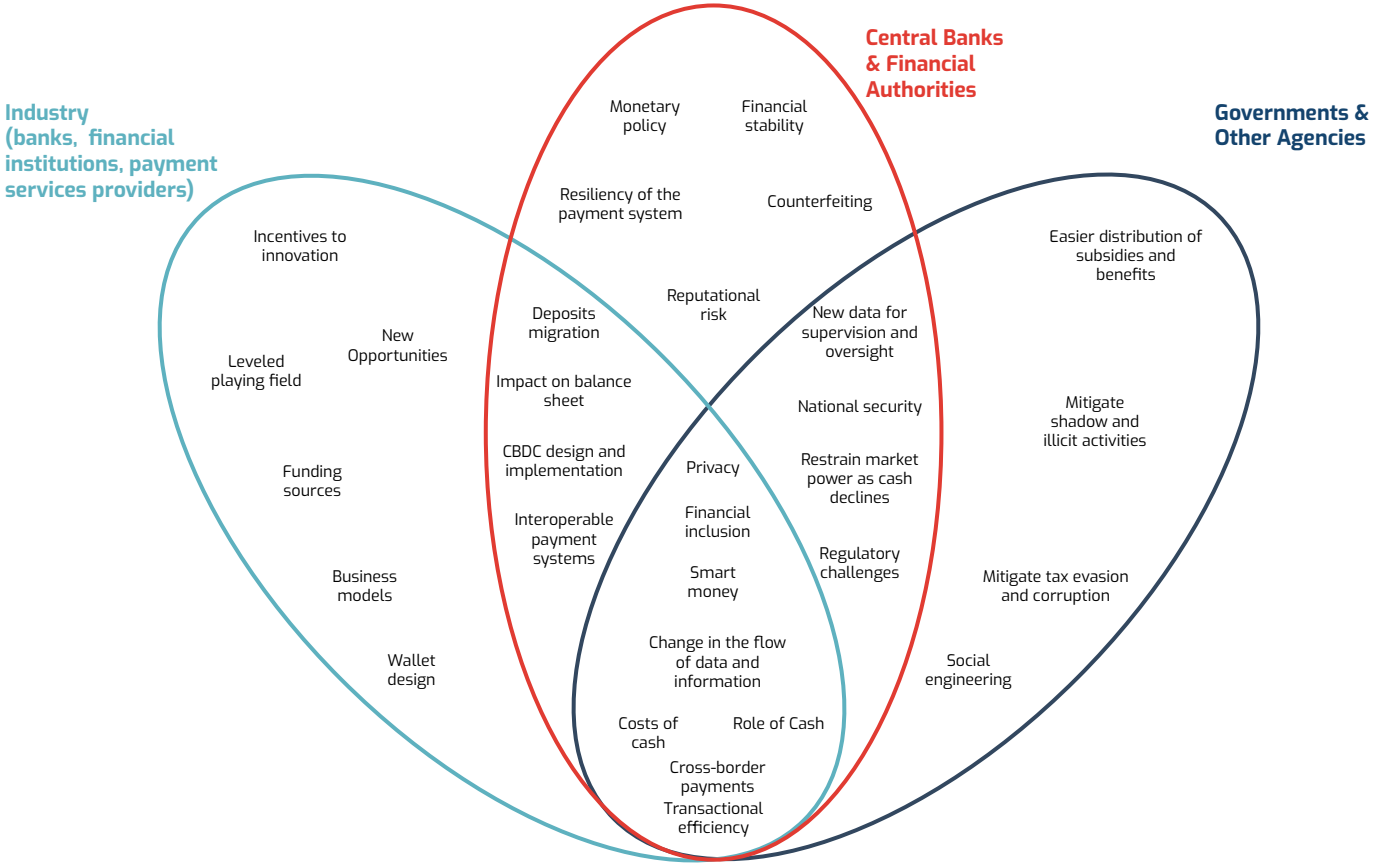
Should CBDC be anonymous? AML/KYC?

How do the wallets work? Do they autodraw funds from accounts in case of limits?

Should a CBDC pay interest? If so, why and how? If not, why not?

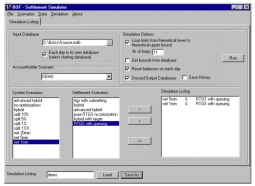
Can foreigners hold CBDC?

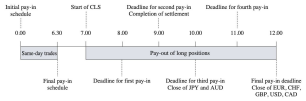
Many Stakeholders with Many Interrelated Concerns

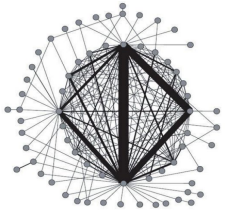


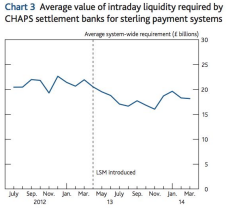
How do we design FMIs today?

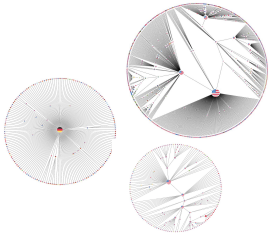
Active Payment Simulations Research & Policy work at ECB, FRB, BdF, BoE, DNB and many others...











1999

Bank of Finland developed the first Payment System Simulator to assess **liquidity impact of joining Target**

2002

CLS goes live after a **regulatory approval process**, setting a precedent of the critical role of simulations

2004-2006

FRBNY and U.S. National Laboratories develop Agent Based Model to assess **attacks on critical infrastructure**

2013

Bank of England **introduces new liquidity savings mechanisms** in CHAPS designed with FNA Simulate - £4b collateral savings for members

2018-

Fnality simulates impact of 'Synthetic CBDC'.

First GSIB simulates its group payments to optimise their settlement with FNA

2021: → CBDC Model & Simulator

Agent-Based Simulation of Central Bank Digital Currencies

28 Pages • Posted: 10 Nov 2021

Amanah Ramadiah
Financial Network Analytics Ltd

Marco Galbiati
S&P Global

Kimmo Soramäki
Financial Network Analytics (FNA)

Date Written: November 9, 2021

Abstract

This paper presents a multi-period agent-based model for the study of macro-financial effects related to the introduction of a retail Central Bank Digital Currency (CBDC). Calibrating it with aggregate statistics of the German retail payment market, we exemplify how the model can be used to quantify the impact of a CBDC on i) the usage of alternative means of payments, ii) the composition of consumer's wealth, and iii) the banking sector disintermediation. We find that CBDC can be configured without largely impacting the banking sector balance sheet. However, we also find those card companies may suffer a substantial decline in their transaction revenues. We see this model as a framework that can be enriched and tuned to answer a myriad of questions relevant to different jurisdictions from a macro-financial angle. The model is publicly available in the FNA simulation platform for running other policy experiments i.e., testing the efficacy of alternative configurations of CBDCs.

Keywords: CBDC, payment systems, agent-based model, economic impact, disintermediation

JEL Classification: C63, E41, G21, G28

Suggested Citation:

Ramadiah, Amanah and Galbiati, Marco and Soramäki, Kimmo, Agent-Based Simulation of Central Bank Digital Currencies (November 9, 2021). Available at SSRN: https://ssrn.com/abstract=3959759 or http://dx.doi.org/10.2139/ssrn.3959759

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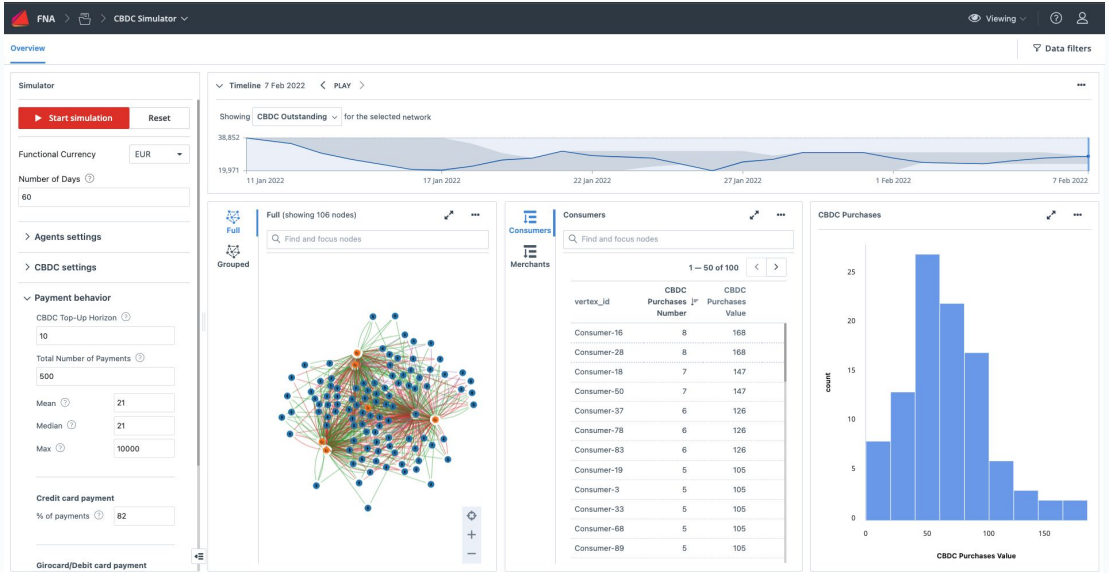
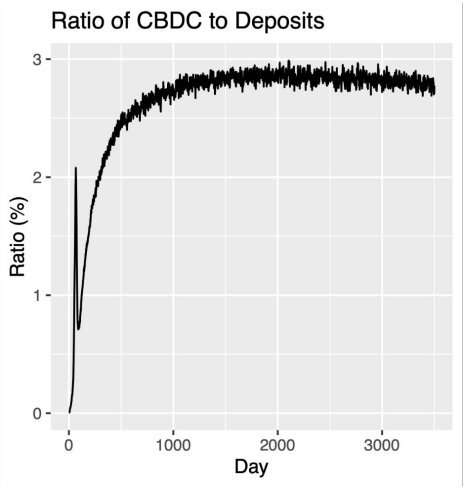


Ramadia, Galbiati, Soramäki (2021)

Impact on Deposits and Payments Instruments

- The total value of CBDC in circulation would be about 2.8% of the total deposits
- The adoption of CBDC led to the decline of cash and card payments- approximately 30%



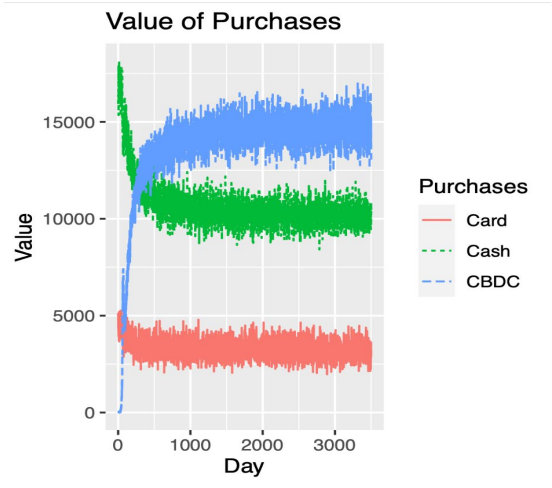


Fig: Left panel: Banking sector disintermediation. The ratio of the total value of CBDC to deposits. Right panel: The relative change in total cash and card transaction values. The CBDC is introduced to the system at $t = 0$.

Key takeaways

- Domestic retail CBDC key for central banks
- Many cBDC initiatives in cross-border wholesale.
  Do we need CBDC?
- Key questions remain on technology, design & adoption
- As well as their impact on policy goals
- Many Proof-of-Concepts on technology already
- We are only beginning to simulate optimal designs and form adoption strategies

Thank you

For further information, please contact:

Dr. Kimmo Soramäki, Founder & CEO
kimmo@fna.fi

Dr. Carlos Leon, Director of FMIs
and Digital Currency Solutions
carlos@fna.fi

www.fna.fi

FNA

Agent-based Models in Money & Banking

Is suited to <u>modelling complex adaptive systems</u> such as the economy where…

- **Agents use simple rules** to guide their behavior (bottom-up model)
- Different agents' interactions combine to produce **emerging behaviour**
- Changes in initial conditions (assumptions) may result in **non-linear changes** in the outcome

Has already delivered strong results:

- **BoE: System-Wide Stress-Test** (Aikman et at., 2019; Farmer et al., 2020)
- **ECB: Funding Risk** (Halaj, 2018)
- **FRBNY & BoE: Payment System** (Beyeler et al., 2008; Galbiati & Soramäki, 2011)
- **Agent-Based Simulation of Central Bank Digital Currencies** (Ramandiah, Galbiati & Soramäki, 2021)*

(*) Presented at the Workshop on Economic Science with Heterogeneous Interacting Agents, 2021, and Central Bank Research Association, 2021

Schematic of the typical elements of an ABM

Stylised CBDC Simulator Model - Agents