Central Bank Digital Currency: Demand Shocks and Optimal Monetary Policy

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joint with Hanfeng Chen

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CBDC macroeconomics and welfare

Key aspects from introducing retail CBDC

- Uncertainty on household adoption with shifts in preferences potentially introducing new sources of macroeconomic fluctuations
- Implications for monetary policy if CBDC becomes an additional policy instrument

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This paper considers **household preferences** for CBDC and **bank market structures** and investigates

1. What is the effect of a shock to the perceived CBDC benefit?
2. What is the optimal CBDC-remuneration rule?

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Literature: Ferrari, Mehl, and Stracca (2020); Bhattarai, Davoodalhosseini, and Zhao (2024)

NK model with CBDC and bank deposits

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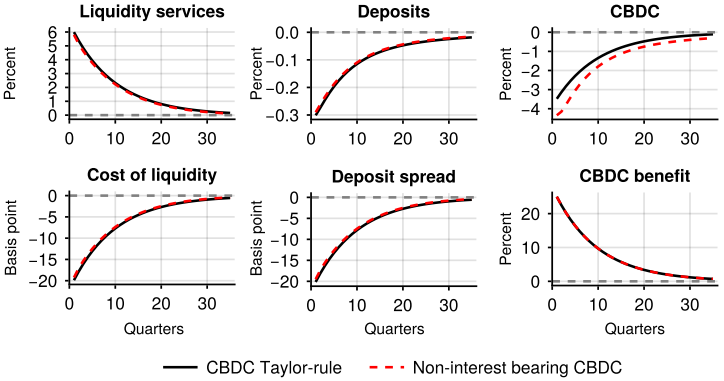
- Nominal rigidities introduced via Calvo pricing
- Government sets **interest rate on government bonds and CBDC** and supplies CBDC elastically to meet demand

▸ Calibration

Transmission of shock to CBDC benefit



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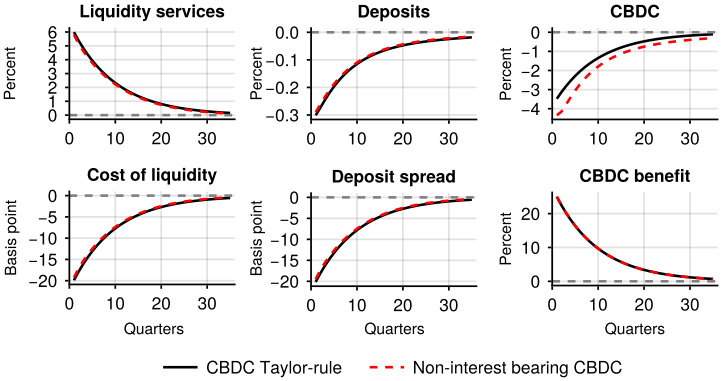
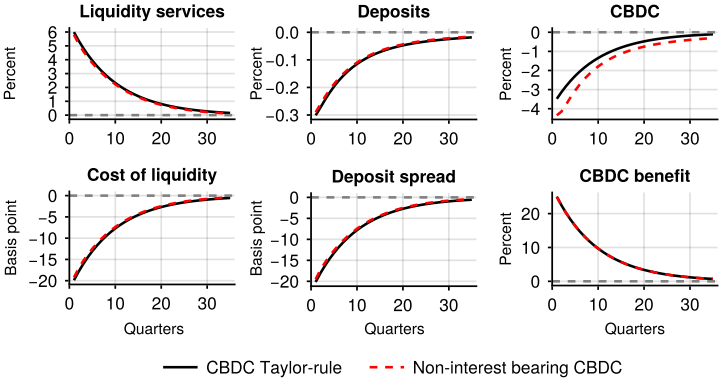


Transmission of shock to CBDC benefit

- Small but positive demand shock effects: ↑ output, consumption, inflation; ↓ investment
- Higher CBDC benefit erodes bank market power, but deposit outflows remain contained



CBDC remuneration and welfare

Government sets CBDC rate according to a Taylor-type rule

$$\ln(R^m_{t+1}) = (1-\rho^m_R)\ln(\bar{R}^m) + \rho^m_R \ln(R^m_t) + (1-\rho^m_R)\left(\theta^m_\pi \ln\left(\frac{\pi_t}{\bar{\pi}}\right) + \theta^m_y \ln\left(\frac{y_t}{\bar{y}}\right)\right) + e^m_t$$

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Optimize simple policy rules (Schmitt-Grohé and Uribe 2007; Faia and Monacelli 2007) conditional on standard Taylor rule for bond interest rate:

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- Gains become substantial with (3)
- Welfare gains increase with CBDC benefit
- Optimal policy responses vary with banking market structure

▸ Household welfare ▸ Optimized CBDC responses

Takeaways

Shock to CBDC preferences has **limited disintermediation effects**

- Competition reduces deposit spreads and weakens bank market power, but deposit outflows remain contained

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CBDC can **complement standard monetary policy**

- Preliminary investigation suggests CBDC rule stabilizes productivity and markup shocks, acting as a complementary instrument to the standard policy rate
- With two separate policy rules, CB can use one to stabilize inflation and the other to focus on output

THANK YOU FOR YOUR ATTENTION

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EXTRA SLIDES

Model calibration

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Parameter	Value	Source/Motivation	Description
Households			
β	0.99	Standard	Discount factor
σ	1	Standard	Risk aversion
ψ	4.55	Piazzesi, Rogers, and Schneider (2022)	Inv. elast. of sub. c and z
ι	1.0	Chetty et al. (2011)	Inverse Frisch elasticity
v	0.08	$z/y = 1.04$ [Bayer et al. (2019)]	Liquidity utility weight
ξ	9.46	$l = 1/3$	Labor disutility
λ	1	Assumption	Benefit of CBDC
ϵ	1/6	Bacchetta and Perazzi (2022)	Inv. elast. of sub. m and n
Banks			
ϕ	0.0008	$\zeta = 0.1945$ [Niepelt (2024)]	Operating cost
φ	1.503	Niepelt (2024)	Operating cost
e	1.38	$k^b/k = 0.3$	Equity
Firms			
α	1/3	Standard	Capital share of output
δ	0.025	Standard	Capital depreciation rate
θ	0.75	Standard	Probability of fixed price
η	1/11	Standard	Inv. elast. of sub. between goods
θ_c	10	Standard	Investment adjustment cost
a	1	Standard	Productivity
Government			
μ_r	0.0003	Niepelt (2024)	Reserves cost
μ_m	0.002	$\mu_m = (\omega + \zeta\mu_r)\lambda$	CBDC cost
ρ_R	0.5	Standard	Bond rate smoothing
θ_π	1.5	Standard	Bond rate response to π
θ_y	0.2	Standard	Bond rate response to y
ρ_R^m	0.5	Assumption	CBDC rate smoothing
θ_π^m	1.5	Assumption	CBDC rate response to π
θ_y^m	0.2	Assumption	CBDC rate response to y
$\bar{\pi}$	1	Standard	Inflation target
$\bar{R}^r$	1.005	$\chi^r = 0.00497$ [Niepelt (2024)]	Reserve rate
$\bar{R}^m$	1	Assumption	CBDC rate

Household welfare

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	Fixed rate (1)	Baseline Taylor (2)	Optimized Taylor (3)
Monopolist banks			
Baseline $\lambda = 1$	-123.8327	0.02%	4.34%
Low $\lambda = 0.9$	-123.5857	0%	4.41%
High $\lambda = 1.1$	-124.0111	0.03%	5.38%
Competitive banks			
Baseline $\lambda = 1$	-126.2246	0.01%	4.16%
Low $\lambda = 0.9$	-126.2499	0.01%	2.25%
High $\lambda = 1.1$	-126.1864	0.02%	7.04%

Optimized CBDC responses

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	Inflation response θ_π^m (1)	Output response θ_y^m (2)	Inertia ρ_R^m (3)
Monopolist banks			
Baseline $\lambda = 1$	4.0	1.872	0.0
Low $\lambda = 0.9$	1.889	1.841	0.0
High $\lambda = 1.1$	0.0	1.947	0.0
Competitive banks			
Baseline $\lambda = 1$	0.0	4.0	0.0
Low $\lambda = 0.9$	0.0	4.0	0.0
High $\lambda = 1.1$	0.0	4.0	0.0