Central Bank Digital Currency and bank disintermediation in a portfolio choice model

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Motivation: CBDC and bank disintermediation?

CBDC may accomplish different policy objectives

- more efficient, secure, and modern central bank money available to everyone
- strengthen resilience, availability, and contestability of retail payments

Key concern:

will CBDC (structurally) disintermediate deposit-taking institutions?

This paper

A (fairly) standard **portfolio choice model with banks** as a **laboratory to analyse disintermediation** when CBDC is introduced

- Banks have market power in deposits
- Love for variety in preferences: positive demand for CBDC
- CBDC is means of payment that i) is cheaper to access than deposits/more efficient in providing liquidity service ii) can pay interest, iii) is accessible to a broad public.

Under what circumstances do total bank deposits fall?

1. only under special conditions: access to CBDC much cheaper than to deposits and relatively **equal wealth** distribution
2. the effect on **lending** is quantitatively **small**

Model setup: overview

Portfolio choice model with a monopolistically competitive banking sector as in Drechsler et al. (2017, QJE):

- Households invest and manage liquidity needs

  Notes (cash) (N), earns no return
  Deposits (D), earn r_D
  CBDC (C), earns $r_C \geq 0$
  Bonds (B) do not provide liquidity services, earn f

- N, C, and B have fully elastic supply
- Banks provide D (set r^D) and invest in B (extension: lending activities and wholesale funding)
- Central bank sets the rates on B (f) and C (r^C)

Households' portfolio choice

- Homogenous households

$$u(W_0) = \max \left[(W^{\frac{\rho-1}{\rho}} + \lambda L^{\frac{\rho-1}{\rho}})^{\frac{\rho}{\rho-1}} \right]$$

- Liquidity services L: $L(N, C, D) = (N^{\frac{\epsilon-1}{\epsilon}} + \delta_D D^{\frac{\epsilon-1}{\epsilon}} + \delta_C C^{\frac{\epsilon-1}{\epsilon}})^{\frac{\epsilon}{\epsilon-1}}$
  - $\rho < 1$: W (wealth) and L (liquidity) are complements
  - $\epsilon > 1$: N (notes), D (deposits), and C (CBDC) are substitutes

  Budget constraint:

$$\begin{aligned} W &= W_0(1+f) - Nf - D(f - r_D) - C(f - r_C) \\ &= W_0(1+f) - s_L L \end{aligned}$$

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  Where s_L: foregone interest, or premium, of holding liquid assets

Banking sector

- There are J identical banks, indexed by j
- Banks provide D_j and invest in B with return f
- Banks act as competitive monopolists in deposits
  - set r_j^D in order to maximize profitability, $D_j(f - r_j^D)$
  - Deposits are aggregated with

$$D = \left(\frac{1}{J} \sum_{j=1}^{J} D_j^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}},$$

where $\eta > 1$: D_j from each bank are substitutes

Equilibrium without CBDC

Assume there is no CBDC ($\delta_C = 0$). Then (as $\lambda \to 0$):

$$r^{D*} = \omega(\cdot) f, \quad \text{where } 0 < \omega < 1$$
$$D^* = \kappa(\cdot) \left(f - r^{D*} \right)^{-\rho}$$

- r^{D*} increases in the policy rate, but less than proportionally (banks' market power)
- Deposits increase in the rate on deposits, and decrease with the policy rate

Equilibrium with CBDC

Assume now the CBDC is introduced ($\delta_C > 0$). Then (as $\lambda \to 0$):

Prop. 1: When CBDC is introduced, r^{D*} **and** D^* **increase**

- Competition from C forces banks to increase r^D

  $\Rightarrow$ banks prevent HHs substituting away from D

- Overall cost of holding liquid assets decline

  $s_l = (f^{1-\epsilon} + \delta_D^{\epsilon}(f - r^{D*})^{1-\epsilon} + \delta_C^{\epsilon}(f - r_C)^{1-\epsilon})^{\frac{1}{1-\epsilon}} \downarrow$

  $\Rightarrow$ demand for liquidity increases, which also increase D holdings

Household portfolio choice: enriched model

- Households differ in initial wealth (W_0, distributed as Pareto)
- Households face a cost to access D (ϕ^D) or C (ϕ^C): assume $\phi^C < \phi^D$

$$u(W_0) = \max \left[(W^{\frac{\rho-1}{\rho}} + \lambda L^{\frac{\rho-1}{\rho}})^{\frac{\rho}{\rho-1}} - \mathbb{1}(\phi) \right]$$

$$\text{where } \mathbb{1}(\phi) \equiv \begin{cases} \phi^C & \text{if } C > 0 \\ \phi^D & \text{if } D > 0 \\ \phi^C + \phi^D & \text{if } C > 0 \text{ and } D > 0 \end{cases}$$

Wealth heterogeneity and costly access: equilibrium

Equilibrium: Households will sort into users of one or more liquidity instruments, depending on their wealth level.

- **Before CBDC**:

  Poorer households will hold only N

  Richer households will also hold D

- **After CBDC's introduction**:
  - Very poor households will hold only N

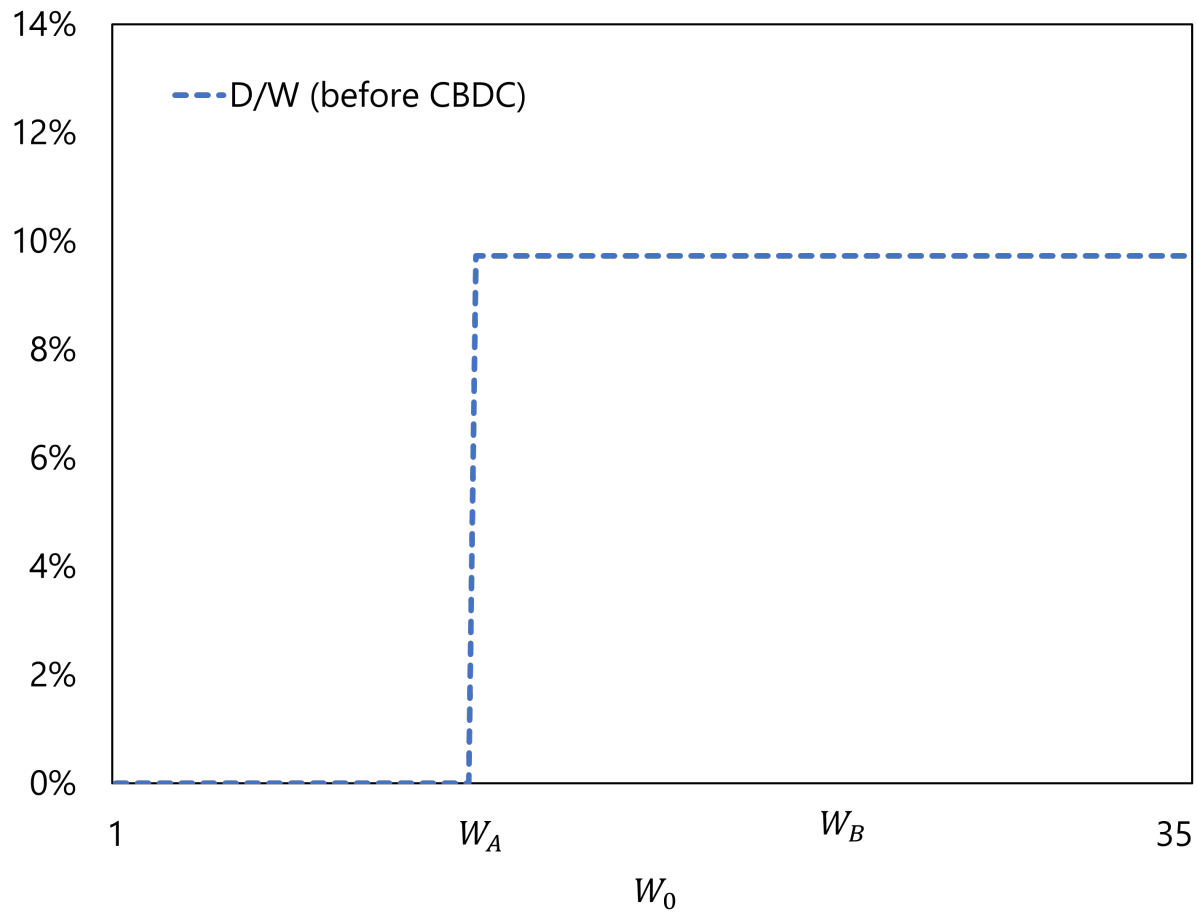
    Middle class households will hold N and C

    Richer households will hold N, C and D

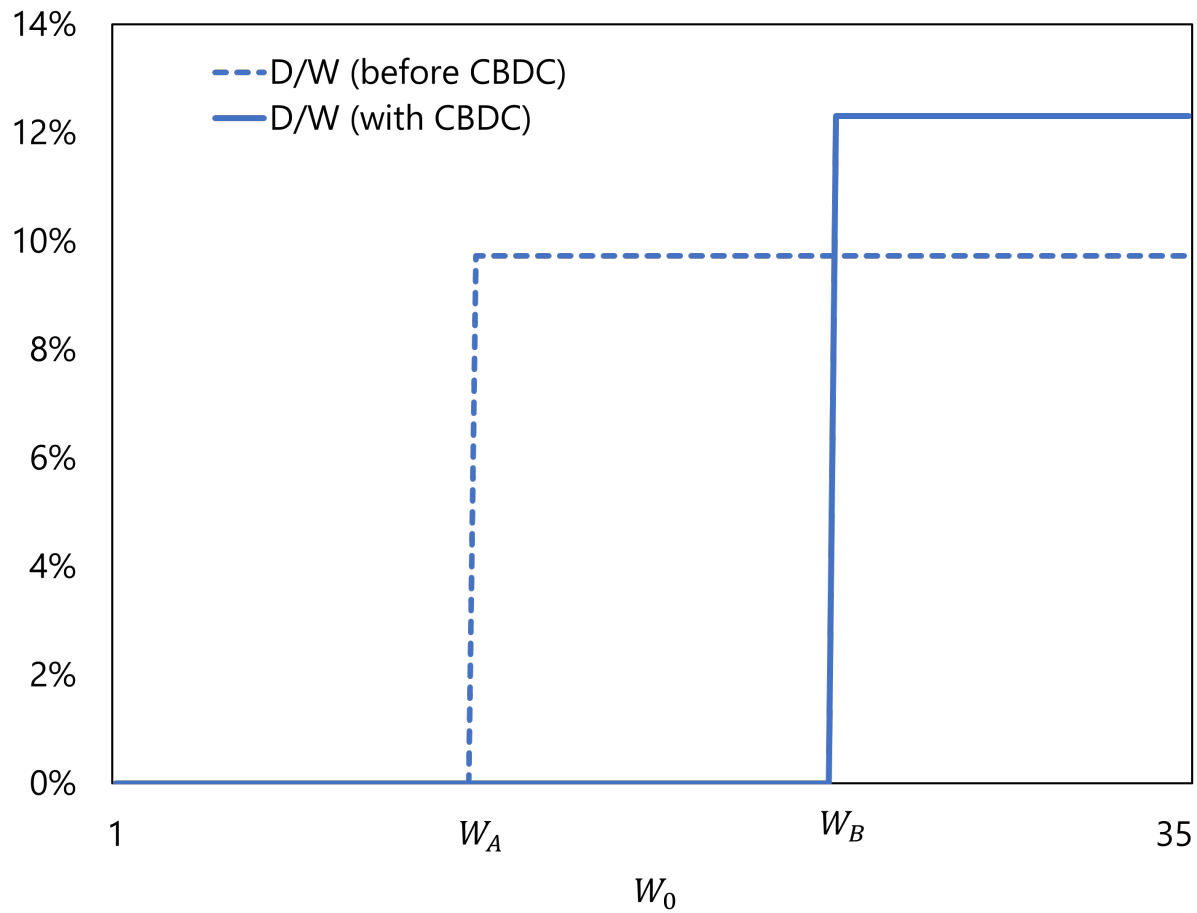
Calibration

Parameter	Value
λ	0.001
ρ	0.2
ϵ	2
η	1.1
J	4
δ_D	1.3
δ_C	1.5
ϕ^D	$0.15 \times \lambda^\rho$
ϕ^C	$0.001 \times \lambda^\rho$
f	0.03
r_C	0

Portfolio adjustment when CBDC is introduced:



Portfolio adjustment when CBDC is introduced:



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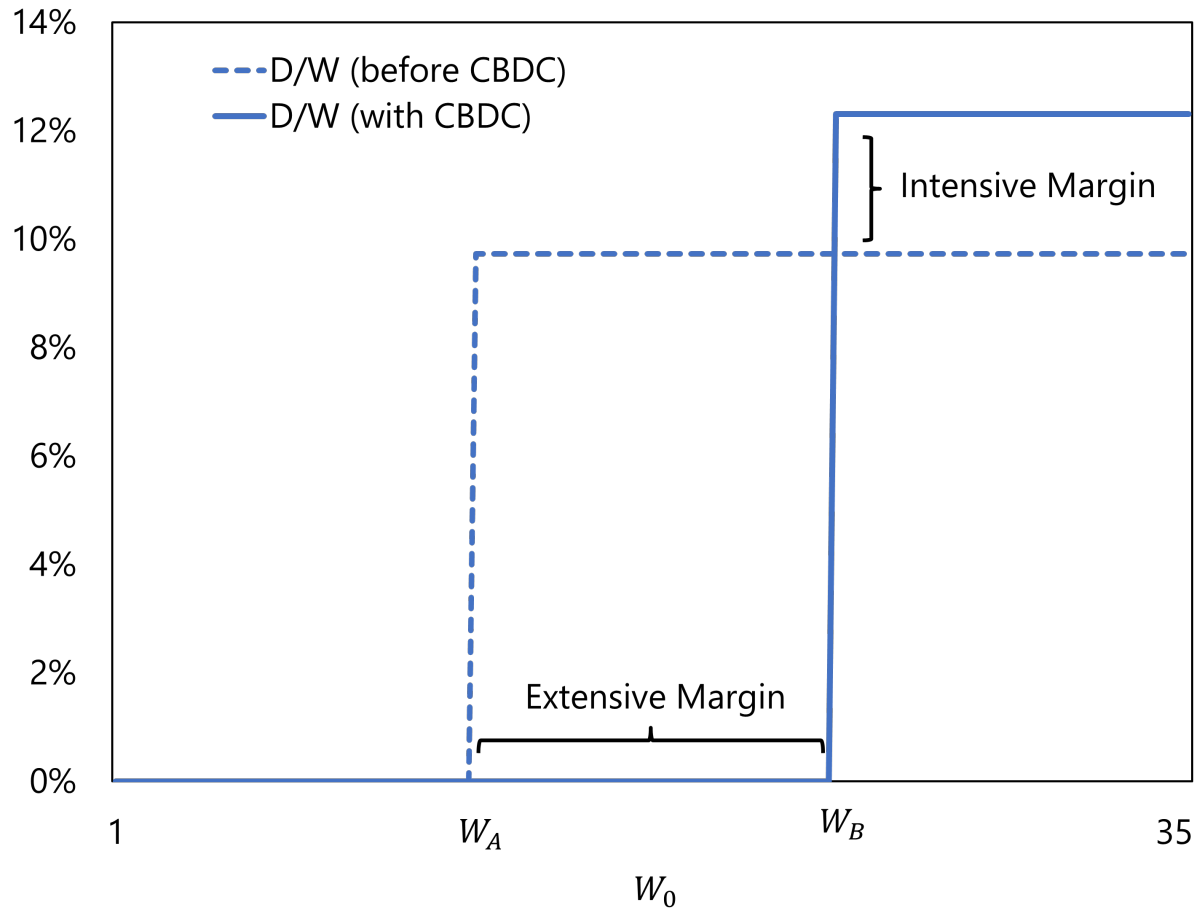

When does CBDC introduction leads to a fall in deposits?

Bank deposits fall under special circumstances:

1. Access to CBDC is much cheaper than bank deposits $\phi^C << \phi^D$
2. Wealth distribution is relatively equal (large Pareto parameter α)

Intuition: Higher deposit rates are not enough to prevent outflow of depositors

- Equal wealth distribution: HHs opting out of deposits account for a large fraction of wealth

What is the impact on lending by banks?

- *Qualitatively*: the introduction of CBDC can lead to a reduction deposits and also to a reduction in lending.
- *Quantitatively*: the drop in lending is very small and it is hard to make it large
  - When wholesale funding is cheap, banks care less about deposits, so the drop in deposits can be large, but the drop in lending is small.
  - When wholesale funding is expensive, banks care more about deposits and increase deposit rate by more, preventing a large loss of funding.

Conclusions and next steps

Portfolio choice model with banks:

- Cash, deposits and CBDC are imperfect substitutes
- Banks have market power in deposits

If there are fixed access costs and households differ in wealth, total deposits **may fall** when CBDC is introduced, **but**:

- only under special conditions
- the effect on **lending** is quantitatively **small**

Next steps:

- discipline calibration
- conduct welfare analysis