Inside Money, Outside Money, and CBDC

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based on: *Should Central Banks Issue Digital Currency?*

joint with Daniel Sanches, FRB Philadelphia

([new version: August 2021](#))

Introduction

- Much current discussion of CBDC and of digital currencies more broadly

  - many interesting economic issues; see Harald's talk yesterday

- I want to focus on one particular issue …

  - the role/desirability of central bank digital currency

- … from a monetary theory perspective

  - that is, focusing on the role of CBDC as a form of *outside money*

- Ideas are based on my paper with Daniel Sanches

- But I will try to present them in a broader context

  - and include some speculative comments that may be of interest

- Yesterday Ricardo asked: What is the problem that CBDC will potentially solve?

- In the policy discussion, the answer is not clear (to me)

- Various rationales are offered

  - many relate to market power in the banking system

  - or to perceived shortcomings of the banking system

    - example: under-provision of services to some communities

  - clear concern about developments that could bring large changes (Libra; Diem)

- One thread: it is important for the public sector to be involved in providing money

  - why? Let's start with a simple model …

Outline

A baseline model

▸ **Start with a simple model of inside money in the LW tradition**

  ▸ a version of Lagos and Rocheteau (2008), for example

  ▸ $t = 0, 1, 2, \dots$

  ▸ each period has CM followed by DM

▸ **Buyers and sellers are completely standard**

  ▸ each is randomly matched in the DM with prob. α

  ▸ no bilateral credit in DM trades (due to anonymity)

  ▸ all DM meetings are identical (for now)

▸ **Only medium of exchange: bank deposits**

  ▸ claims issued by banker/firms, backed by real investment

  ▸ universally recognized, verifiable, etc.

▸ **Each banker has access to a single productive project**

  ▸ requires fixed input in today's CM → normalize to 1

 ▸ generates output γ_j in the next period CM (heterogeneous)
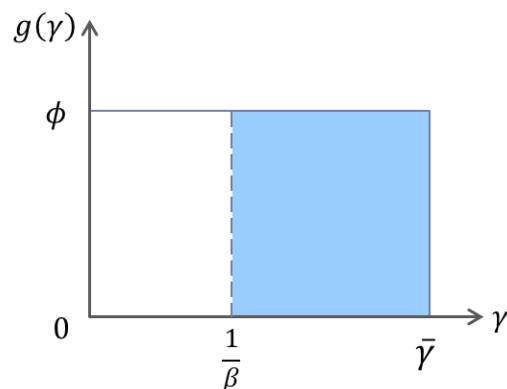
⇒ diminishing returns to
  (aggregate) investment

▸ **Bankers have no endowment → borrow by issuing deposits**

  ▸ claim redeemable for CM consumption next period

  ▸ competitive: pay market interest rate $1 + r_D$

  ▸ can borrow if: $1 + r_D \leq \gamma_j$

Equilibrium

▸ **Buyers' demand for deposits is standard**

    ▸ assume utility is such that deposit demand is increasing in $1 + r_D$
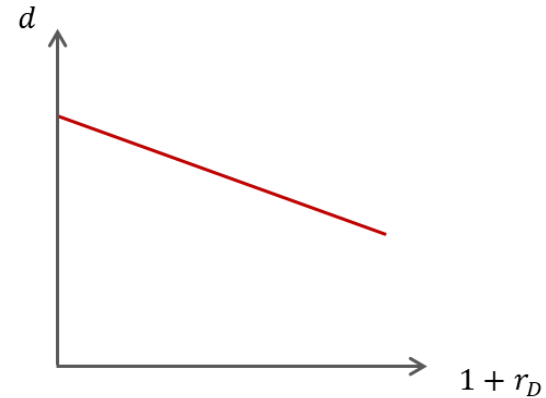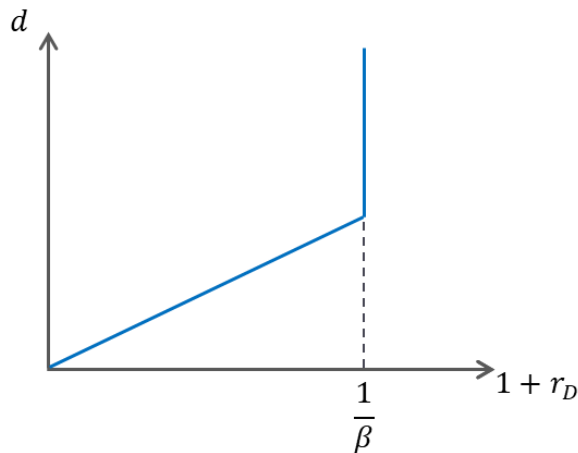
▸ **Bankers' supply of deposits is determined by …**

    ▸ … the distribution of productivities γ_j

    ▸ height of curve = measure of bankers satisfying $\gamma_j \geq 1 + r_D$

        ▸ or, the measure of bankers whose project is profitable

Two cases

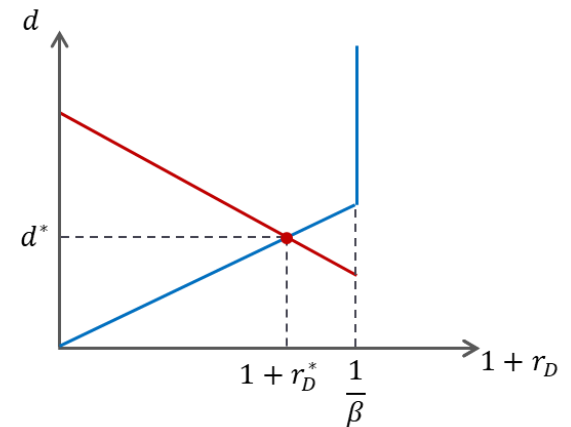▸ **If high-return projects are plentiful:**

  ▸ equilibrium interest rate $1 + r_D^* = \frac{1}{\beta}$

  ▸ trade in DM meetings is efficient (q^*)

  ▸ allocation is first-best

▸ **If high-return projects are scarce:**

  ▸ $1 + r_D^* < \frac{1}{\beta}$ (liquidity premium)

  ▸ less trade in DM meetings ($< q^*$)

  ▸ overinvestment in CM

▸ **"Problem": private sector's ability to create money is limited**

  ▸ limited by the set of productive projects available

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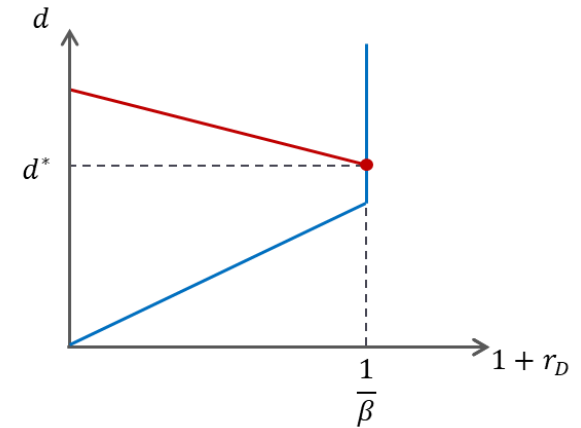
A solution

▸ One way to address this "problem" is … outside money

▸ Introduce a central bank that can issue (physical) currency

  ▸ durable, recognizable by all sellers, etc.

  ▸ sets gross growth rate of money supply μ

  ▸ balances budget each period with lump-sum taxes/transfers

focus on the stationary monetary equilibrium

▸ Optimal policy: Friedman rule (set $\mu = \beta$)

  ▸ equilibrium interest rate on deposits will adjust: $1 + r_D = \frac{1}{\beta}$

  ▸ total money balances (inside + outside) increase

  ▸ trade in DM meetings becomes efficient (q^*)

  ▸ inefficient CM projects are no longer funded

  ⇒ equilibrium allocation becomes first best

Summary (of the simple baseline model)

▶ Why might it be important for the public sector to be involved in providing money?

▶ One answer: outside money increases the stock of liquid assets

  ▶ lowers liquidity premia, leads to higher DM trade

▶ Outside money can "crowd out" inside money in the process

  ▶ by lowering liquidity premia (here: raising $1 + r_D$)

  ▶ which raises the required interest rate on investment

▶ But this "disintermediation" is a good thing

  ▶ increases net CM output; inefficient projects are no longer funded

  ▶ in a broader setting: might reduce production of low-quality "safe" assets; improve financial stability ($\star$)

Outline

Electronic money

▸ **Physical currency is difficult to use in many settings**

  ▸ suppose the DM meetings involve large values, distant parties

  ▸ achieving the benefits above requires *electronic* outside money

▸ **One rationale for CBDC:**

  ▸ providing outside money that can be used in more situations

  ▸ in the model: relabel "currency" with "CBDC"

  ▸ optimal policy is unchanged: issue CBDC and run Friedman rule

▸ **Note: no new technology required (blockchain, etc.)**

▸ **This approach could have been adopted long ago**

  ▸ in fact, was advocated by Tobin (1985)

  ▸ why wasn't it?

Disintermediation

▸ Substantial concern that a better form of outside money will disintermediate banks

▸ This issue is commonly raised in policy discussions:

"[A] flow of retail deposits into a CBDC could lead to a loss of low-cost and stable funding for banks."

BIS (2018)

"A consequence could be higher interest rates on bank loans."

Mersch (ECB, 2017)

"[D]o the benefits … get outweighed by the negative consequences of the central bank disintermediating a large part of bank business models?"

Meaning et al. (BoE, 2018)

▸ *Economist:* "The disintermediation dilemma" (12/5/20)

▸ Disintermediation occurs in our baseline model, but raises net CM output and welfare

  ▸ are these concerns misguided?

▸ Keister & Sanches: make one modification to baseline model

  ▸ a banker can only credibly pledge a fraction $\theta < 1$ of their output

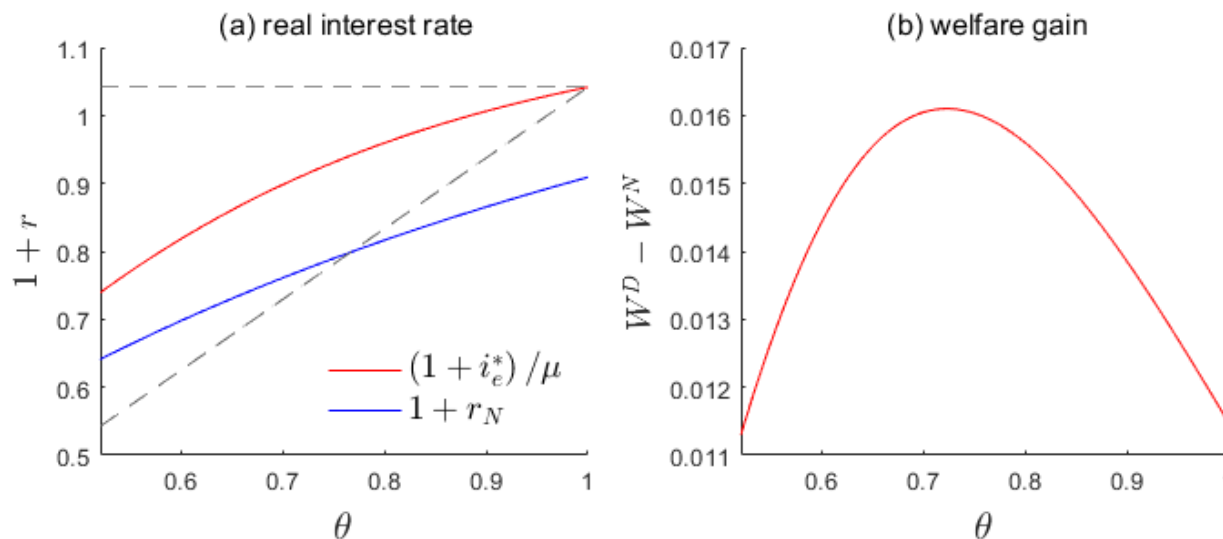   ▸ as in Kiyotaki & Moore (1997), others

  ▸ is funded only if

$$1 + r_D \leq \theta \gamma_j$$
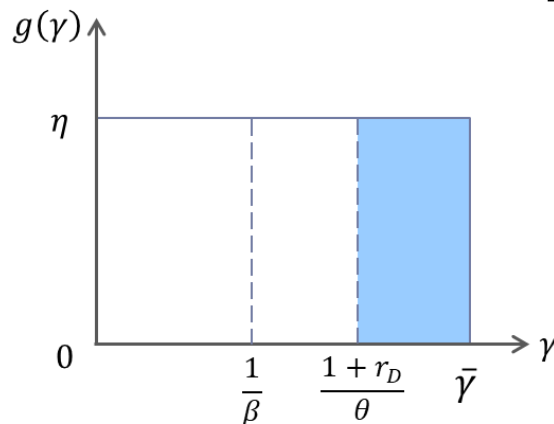
▸ $\frac{1+r_D}{\theta} > \frac{1}{\beta} \Rightarrow$ cutoff is inefficiently high

▸ some *socially-productive* projects are not funded

- ▸ This financial friction introduces a tradeoff

- ▸ Making outside money more attractive (i.e., lowering μ):

  - ▸ increases total money balances, moves DM trade toward q^*

  - ▸ but may disintermediate <u>socially-desirable</u> CM projects

    - ▸ captures important elements of the policy discussion

- ▸ Result: CBDC may or may not be desirable

- ▸ We show that CBDC raises welfare under the optimal policy if:

  - ▸ high-return projects are in sufficiently scare supply

    - ▸ and, therefore, the liquidity premium on deposits is large enough

  - ▸ or if the baseline equilibrium has overinvestment

- ▸ How does the desirability of CBDC relate to the friction θ?

An example

(a) real interest rate — $1+r$ vs θ, with curves $(1+i_e^*)/\mu$ (red) and $1+r_N$ (blue)

(b) welfare gain — $W^D - W^N$ vs θ

Illustrates two general points:

▸ Optimal (real) interest rate converges to $\frac{1}{\beta}$ as $\theta \to 1$

▸ Welfare gain is largest for intermediate values of θ

  ▸ as θ decreases, two competing effects:

    ▸ liquidity premium increases → larger benefit of CBDC

    ▸ but disintermediating the marginal project becomes more costly

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3. CBDC

   ‣ outside electronic money

   ‣ multiple CBDCs

4. Discussion

   ‣ central bank lending

   ‣ synthetic CBDC

   ‣ stablecoins

5. Wrap up

▸ CBDC might also be a useful substitute for physical currency

▸ To capture this, add a second type of DM meeting

  ▸ some sellers will only accept cash (physical or digital)

  ▸ policy maker discounts the surplus from these meetings by $v \leq 1$

    ▸ some of this activity is illicit (Williamson, 2012)

▸ CBDC has the advantage of being (potentially) interest-bearing

  ▸ suppose we fix the inflation rate (2%)

  ▸ if v is high enough, policy maker would like buyers entering this type of meeting to have interest-bearing money

▸ But: the desired interest rate will typically be different from the one we derived above

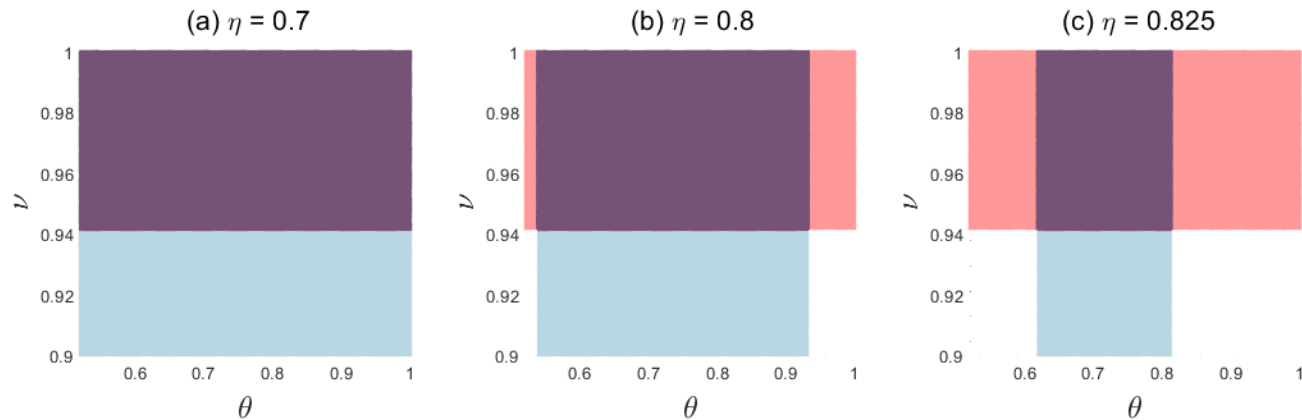 ▸ how should policy makers deal with this tension?

Multiple CBDCs

▸ The policy maker would like to issue two distinct CBDCs

▸ One CBDC is "cash-like" → can only be used in "cash" meetings

  ▸ in practice: a stored-value card that must be physically present

  ▸ interest rate is chosen based on ν (modified Friedman rule)

▸ The other CBDC is "deposit-like"

  ▸ in practice: debit card, uses existing payments network

  ▸ interest rate chosen based on tradeoff discussed above

▸ The idea of multiple CBDCs has not received much attention

  ▸ but has clear benefits in this environment

  ▸ and seems like it would be useful in a variety of environments

However

- The multiple-CBDC approach requires *restrictive* designs
  - the "cash-like" CBDC can <u>only</u> be used in meetings where cash is currently used
  - the "deposit-like" CBDC can <u>only</u> be used in meetings that currently use bank deposits

- Such designs may or may not be feasible
  - perhaps the "better" CBDC can be used by all buyers ("universal")

- If not, optimal policy becomes more complex
  - policy maker chooses a single interest rate to balance all concerns
  - taking into account both intensive and extensive margins
    - optimal policy may lead to CBDC being used in only one type of meeting

- For the details → see the paper

CBDC use under the optimal policy

▸ Targeted:
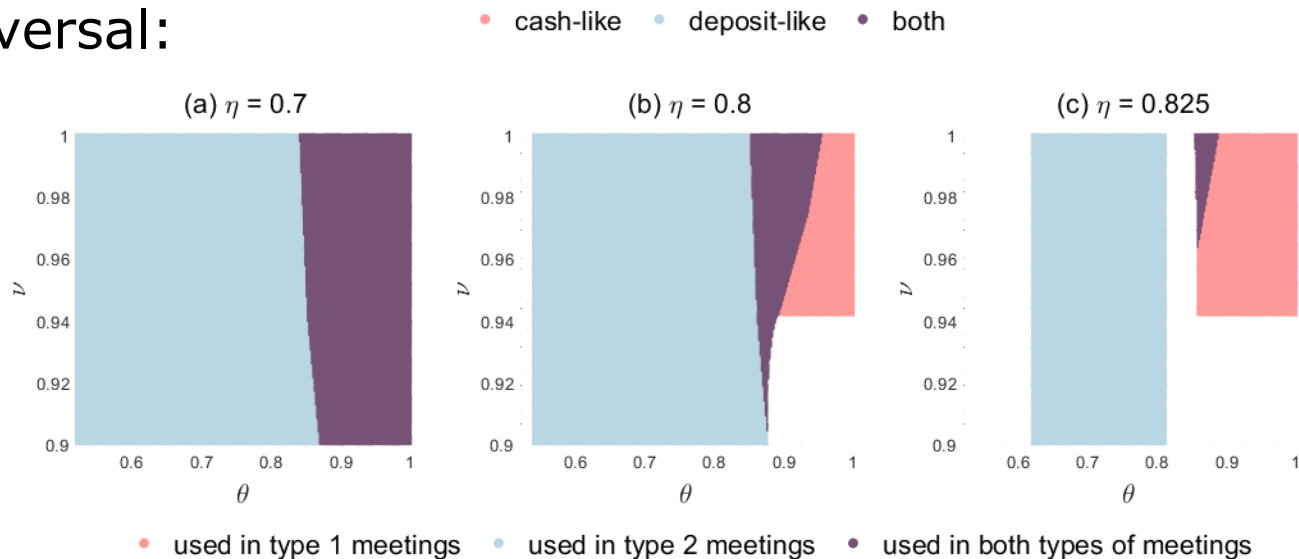
(a) $\eta = 0.7$ (b) $\eta = 0.8$ (c) $\eta = 0.825$

● cash-like   ● deposit-like   ● both

▸ Universal:

(a) $\eta = 0.7$ (b) $\eta = 0.8$ (c) $\eta = 0.825$

● used in type 1 meetings   ● used in type 2 meetings   ● used in both types of meetings

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Central bank lending

▸ One response to disintermediation concerns:

  ▸ the central bank can lend to banks, replacing the lost deposits

▸ In our model, CB lending to banks is <u>neutral</u>

▸ Idea: given the real return on holding CBDC:

  ▸ competition and arbitrage pin down rates on loans, deposits

  ▸ which pin down total real money balances and investment

▸ CB lending to banks crowds out private deposits one-for-one

  ▸ when CB lends $1 to banks, buyers shift $1 from deposits to CBDC

  ▸ version of the equivalence result in Brunnermeier & Niepelt (2018)

▸ Implication: CB lending does not "undo" disintermediation

Another interpretation

▸ Suppose the central bank creates CBDC by lending to banks

  ▸ for example: could directly lend the CBDC to bankers

  ▸ who exchange the CBDC for goods they can invest

▸ This CBDC would be *inside money* in the original sense of Gurley and Shaw (1960)

  ▸ based on (or "backed by") private debt of the bankers

    ▸ see Lagos (2010; New Palgrave)

▸ In other words, <u>inside</u> CBDC is neutral in this setting

  ▸ one form of inside money (CBDC) replaces another (deposits)

▸ Benefits discussed above come not from CBDC *per se*

  ▸ but from having <u>outside</u> money that can be used more widely

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Narrow banks

▸ Consider the following arrangement:

  ▸ a private bank issues interest-bearing deposits

  ▸ backed 100% by interest-bearing reserves at the central bank

Q: Is this arrangement equivalent to having a CBDC?

▸ IMF says 'yes'

  ▸ call it "synthetic CBDC" (Adrian and Mancini-Griffoli, 2021)

▸ BIS and others say 'no'

  ▸ define a CBDC to be a "direct liability of the central bank"

  ▸ "Synthetic CBDC is not a CBDC" (joint CB report, 2020)

▸ What should one make of this debate?

  ▸ let's think in terms of inside and outside money …

- Deposits in a narrow bank are outside money

  - "backed by some asset [reserves] that is not in zero net supply within the private sector of the economy" (Lagos, 2010)

- In our framework, could add "narrow bankers"

  - take deposits from buyers, hold interest-bearing reserves at CB

- Result: 'direct' and 'synthetic' CBDC are equivalent …

  - if there are no incentive constraints on narrow bankers

  - idea: reserve holdings are easy for outsiders to monitor

- If narrow bankers can only pledge a fraction their reserves …

  - direct CBDC is more efficient; bypasses bankers' incentive constraint   (see Williamson, 2021)

  - one way of interpreting the comments of the BIS, others

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Stablecoins

‣ Stablecoin: crypto asset that aims to maintain a stable value

  ‣ relative to some existing asset, say, the U.S. dollar

‣ At first, seems like a strange idea

  ‣ if I want an asset whose value is stable relative to the US$ …

  ‣ why not just hold US dollars? (that is, a bank deposit)

‣ Answer: for some activities, money needs to be tokenized

  ‣ that is, useable in a blockchain-based transaction

‣ Suppose I want to buy bitcoin, using dollars

  ‣ and I don't want to go through an intermediary (i.e., an exchange)

  ‣ I want to be sure I transfer the dollars to the seller *if and only if* the bitcoin are transferred to me (delivery vs. payment)

▸ This type of direct trade can be done using smart contracts

  ▸ but not using money in my checking account

  ▸ that money is electronic ("digital"), but not blockchain-friendly

▸ Stablecoins are like bank deposits, but "tokenized"

  ▸ meaning they can be transferred on a blockchain

▸ Stablecoins are (mostly) a form of inside money

  ▸ backed by assets that include commercial paper, loans, etc.

Q: Is there a role for *outside* tokenized money?

  ▸ is there a "problem" here that CBDC might solve?

- Previous discussion encourages us to think about:

  - what is the optimum quantity of tokenized money?

  - can (or will) the private sector produce that quantity?

    - what are the constraints on the production of inside tokenized money?

- Financial stability considerations are also likely important

  - much of our inside electronic money is tightly regulated

    - bank deposits, money market mutual funds, etc.

  - and also has access to a lender of last resort

  - inside tokenized money (stablecoins) have neither

    - may be susceptible to runs

    - is there a role for outside tokenized money to displace "risky" inside money? (⋆)

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Conclusion

- New types of digital currency raise many interesting questions

    - some questions are new, related to technological aspects

    - but others are classic questions in monetary theory

        - suddenly relevant for current, important policy decisions

- Money and payments may be noticeably different in 20 years

    - but underlying questions will still be about how exchange can/should be organized

- Serious monetary models have a lot to contribute

    - both conceptually and to the practical policy debate

- I am encouraged by the interesting work going on

    - and look forward to seeing more in the future.