Conference on
The Future of the Monetary System

CBDC: Money vs. Payments

Todd Keister
Rutgers University

Bank of Canada

September 26, 2024

Outline

- Motivation
- Payments
- Money
- Concluding remarks

Research on CBDC

- A divide has arisen between:

  (i) how policy makers in various jurisdictions talk about CBDC

  (ii) the way many research papers model CBDC

- Divide is highlighted by Bindseil & Senner (EBC, 2024)
- They say: CBDC is a "conservative response" to ↓ cash usage
  - goal: preserve the role of central bank money
  - emphasize: no central bank plans to pay interest in CBDC
    - and CBDC will have strict holding limits, etc.
- But many papers study scenarios where CBDC bears interest
  - and where the quantity in circulation may be large
    - and thus has macro effects (on banks, investment, etc.)

- B&S argue this research is misguided. Researchers:
  - "need to accept the reality that CBDCs will not be remunerated for the foreseeable future, and that circulation will be subject to individual holding limits"
  - "should devote their energy to this reality, and not to a hypothetical alternative world"

  → we should take a 'narrower view' of CBDC
- In this narrow view, CBDC is (primarily) about payments …
  - updating a historically popular *means of payment* for the digital age
  - issues: deciding how much privacy it will offer, offline use, etc.
- … not a broad change in the *monetary* system
- Interesting arguments, and points well taken. BUT …

- CBDC is also a *monetary asset*
- Policy makers can try to limit that role
  - make it not-too-attractive; just an "update" of physical currency

1) Changes in currency in circulation can have macro effects
   - ~8% of GDP in the U.S.
   - making CBDC "cash-like" $\not\Rightarrow$ we can ignore broader effects
     - Chiu & Davoodalhosseini (2023)

2) Things change. Sometimes very quickly
   - in unusual times, unexpected changes occur, including in CB policy

- Debate reminds me of the history of another policy issue …

Interest on reserves in the U.S. (a digression)

- Historically, the Fed paid no interest on bank reserves
- Long recognized by economists (and bankers) as a distortion
  - requiring banks to hold reserves proportional to deposits …
    - … and earn a well-below market rate on those reserves …
    - … is a tax on the activity of banking
  - paying interest was advocated by Friedman (1960), among others
- By the 1990s: the Federal Reserve Board favored paying interest on required reserves
  - doing so required authorization from Congress
  - interesting to look at the arguments Fed officials made at the time

Rationale

- Main concern: implementing monetary policy
- Because holding reserves was very costly …
  - banks found ways to minimize their required reserves ("sweeps")
- Fed's operational framework relied on a large and predictable demand for reserves
  - "*Declines in required reserve balances through avoidance schemes could lead to increased volatility in the federal funds rate*."
  - "*Accordingly, allowing the Board to pay interest on required reserve balances would … alleviate risks that could affect monetary policy and the smooth functioning of the money markets.*"
    - Gov. Meyer, Congressional Testimony, 1998

In other words

- IOR is a "conservative response" to a changing environment
  - want to stop the downward trend in required reserves
- Fed officials noted: some other central banks pay interest on *excess* reserves
  - at a below-market rate, as part of a corridor system
- But "*… the Federal Reserve sees no need to pay interest on excess reserves in the near future*"
  - Gov. Kohn, Congressional Testimony, June 2004
- Some internal discussion: how could this new tool be used?
  - thinking broadly: should excess reserves earn interest?
  - reaction: focus on reality, not a hypothetical alternative world

And then …

Unusual times

- Sept. 2008: Following the collapse of Lehman Bros. …
  - emergency actions substantially expanded Fed balance sheet
  - but the target Fed funds rate was still positive (2% in mid October)
- Only way to have a hope of hitting the target:
  - pay interest on excess reserves (at ≈ the target rate)

⇒ Paying interest on excess reserves went from a fringe idea …

  - … to being essential for monetary policy *in a few weeks*

- The statements of Meyer, Kohn and others were not wrong
  - but the "foreseeable future" was a lot shorter than expected
  - thinking broadly about alternatives turned out to be important

Back to CBDC

- In times of turmoil:
  - the tools available to a central bank will (and should) be used
  - often in innovative, perhaps unexpected ways
- Introducing a CBDC gives a central bank new tools
  - remuneration, holding limits, aggregate quantity limits, etc.
- Have plans for how these tools will be used
  - can try to commit through communication, rules, maybe legislation
- But … things change

  ⇒ policies, rules, and legislation can all change in response

The future monetary system

- Our job as researchers: study a broad range of possibilities
  - we study "hypothetical, alternative worlds"
  - ask: when is a given policy desirable? Or undesirable?
    - what *should* policymakers do given the available tools?
- Our focus should include current plans for CBDC design/use
  - many interesting issues to study here
- But should *not* be limited to this narrow set of policies
  - ask how CBDC could and should be used in different environments
  - the answers may be relevant sooner than we expect

Money vs. Payments

- I have referred to "narrow" and "broad" views of CBDC
  - narrow: design features and uses currently being discussed by policy makers
  - broad: everything else
- But this divide can be described in another way

  Q: What is CBDC really about? Money or Payments?

Outline

- Motivation
- Payments
- Money
- Concluding remarks

- The narrow view of CBDC …
  - with zero interest, strict holding limits, etc.
- … envisions it being (primarily) about payments
- Extreme case: set the holding limit to *zero*. But include:
  - waterfall: if you receive a payment that puts you above the limit, the excess amount is transferred to your (linked) bank account
  - reverse waterfall: if you make a payment larger than your balance, the excess amount is taken from your bank account

⇒ CBDC is just a way to transfer balances across bank accounts

- from user's perspective: like Apple Pay linked to bank accounts (or how I use Venmo)

- In practice, holding limits will be positive
  - essential for allowing offline transactions, for example
  - which starts to raise other issues
    - leaving that aside for a moment …

Q: Can a "pure payments" CBDC be useful?

- There are some interesting issues here
  - will it be used? (Nocciola and Zamora-Perez, 2024)
  - privacy features? (Ahnert et al., 2024)
  - effects on competition? (Assenmacher et al, 2024 ; Chiu et al., 2023)
    - and others

But …

Two points

1) Thinking only about payments sells CBDC short

- leads us to evaluate desirability based (only) on payment needs
- "*At this stage, the public is well-served by the existing payment options and systems available in Australia, and no clear public interest case for retail CBDC has emerged.*"
  - Reserve Bank of Australia (2024)
- there might be other things going on that a CBDC could help with

2) A "pure payments" CBDC may end up doing more over time

- holding limits may be increased following some shock(s)
- zero interest is an attractive rate in some environments

⇒ Important to look at CBDC as money

Outline

- Motivation
- Payments
- Money
- Concluding remarks

Money and assets

- Money is an integral part of economic activity
  - facilitates trade, production, finance, etc.
- Is typically "backed" by something that guarantees its value
  - can be private credit (loans, securities, etc.) — inside money
  - or government bonds — outside money
    - or the central bank (future seigniorage profits)
- The assets backing money have privileged financing
  - financed more easily, at lower cost, more securely, etc.

⇒ The composition of the assets backing money matters

- highlighted by Gurley and Shaw (1960), others

- The banking system can produce both types of money
  - by making loans or by purchasing govt bonds
  - as can the central bank
- But the *composition* typically differs
  - private banks respond to financial incentives
    - tends to tilt toward inside money (more in a minute)
  - central banks: assets held are a policy choice
- If households shift from using currency to bank deposits …
  - may create a shift in the assets backing the money supply

Q: Is this a concern? Could CBDC play a role?

A model

- To address these questions, I will sketch a model
- Similar to Keister and Sanches (2023)
  - builds on Lagos & Wright (2005), Lagos and Rocheteau (2008), etc.
  - buyers and sellers need a medium of exchange (deposits)
  - bankers/firms issue deposits, invest and produce
- Add to this environment:
  - aggregate risk, limited liability and deposit insurance
  - government debt
- Leave out:
  - limited pledgeability, physical currency

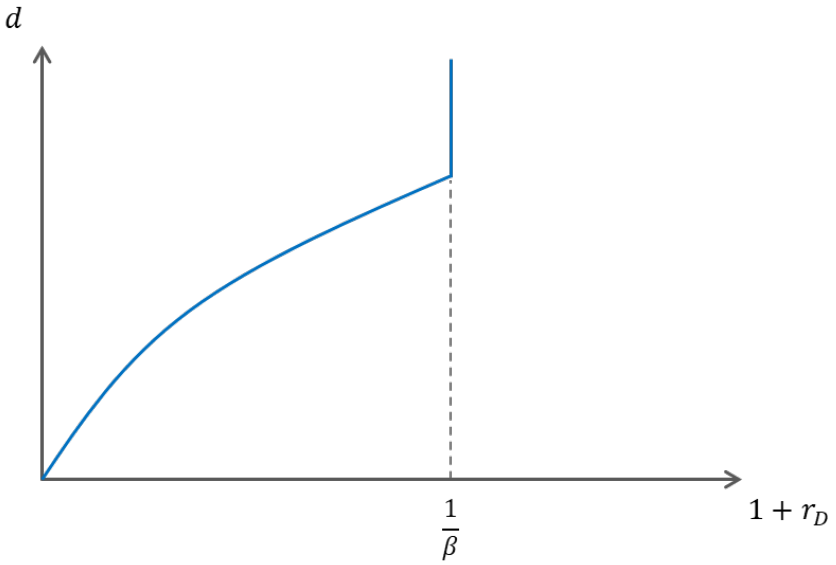
Households

- Households use bank deposits to make purchases
- Choose a quantity d of deposits based on:
  - anticipated transaction needs and opportunities
  - and attractiveness of the medium of exchange

ease of use, safety, etc.

- Focus on: interest rate $1 + r_D$
- Deposit demand is:
  - increasing in $1 + r_D$
  - vertical at $1 + r_D = \frac{1}{\beta}$

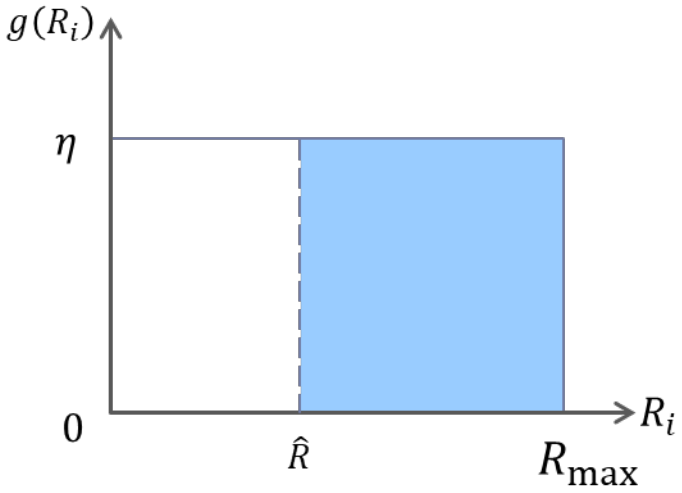
because of quasi-linear preferences



⇒ Higher d corresponds to more economic activity (good)

Banks

- Bankers have access to a set of productive projects
  - each requires fixed input (1) plus operational cost (χ)
  - output in the next period is:
    - R_i in the good aggregate state (heterogeneous)
    - $(1-\sigma)R_i$ in the bad state, where $\sigma > 0$
  - $R_i \sim [0, R_{\max}]$ $\Rightarrow$ diminishing returns to (aggregate) investment



will fund all projects above some cutoff $\hat{R}$

key question: what determines $\hat{R}$?

- Bankers are risk neutral, competitive
  - can think of a single, representative bank
- Can also invest in government bonds
  - pay $(1 + r_B)$ in all states
  - can also interpret as *reserves*
- Can issue deposits at interest rate $(1 + r_D)$
  - competitive deposit market (for simplicity)
- If the absence of frictions:

$$\max_{\{\hat{R},b,d\}} \int_{\hat{R}}^{R_{\max}} \left((1-q)R_i + q(1-\sigma)R_i\right)dR_i + (1+r_B)b - (1+r_D)d$$

$$s.t. \qquad d = (1+\chi)\left(R_{\max} - \hat{R} + b\right)$$

Equilibrium

- Equilibrium welfare depends on two key quantities
  - (i) deposits d: higher is always better (more economic activity)
  - (ii) investment cutoff $\hat{R}$: want to fund (only) good projects
    - expected return higher than the social cost of funds
- Common tension in monetary models:
  - demand for deposits is large relative to stock of productive projects
  - households economize on deposits; a *liquidity premium* emerges
- I will look at equilibrium in four cases
  1. Efficient benchmark
  2. Limited liability
  3. Regulation
  4. Regulation plus CBDC

A benchmark

$$\max_{\{\hat{R},b,d\}} \int_{\hat{R}}^{R_{\max}} \left((1-q)R_i + q(1-\sigma)R_i\right)dR_i + (1+r_B)b - (1+r_D)d$$

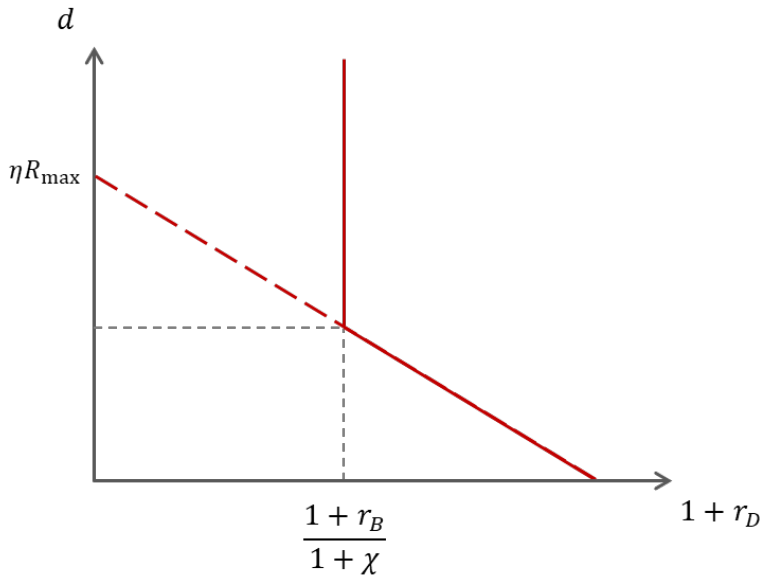
$$s.t. \quad d = (1+\chi)\left(R_{\max} - \hat{R} + b\right)$$

- If $(1+r_D) > \frac{1+r_B}{1+\chi}$:
  - set $b = 0$, operate projects with:

$$(1-\sigma q)R_i \geq (1+r_D)(1+\chi)$$

- If $(1+r_D) = \frac{1+r_B}{1+\chi}$:
  - $b \geq 0$, operate projects with

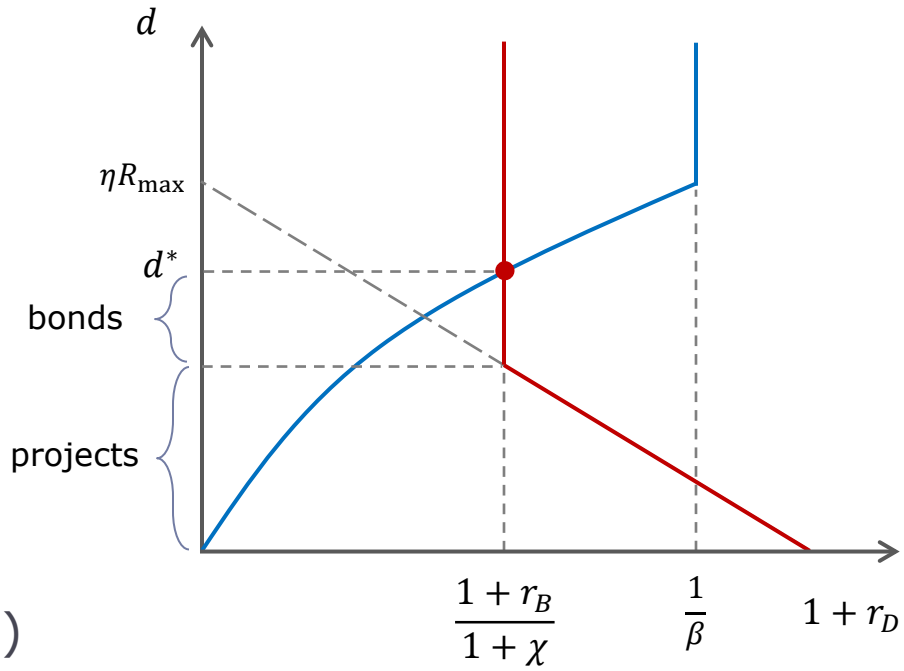
$$(1-\sigma q)R_i \geq (1+r_B)$$



supply of deposits

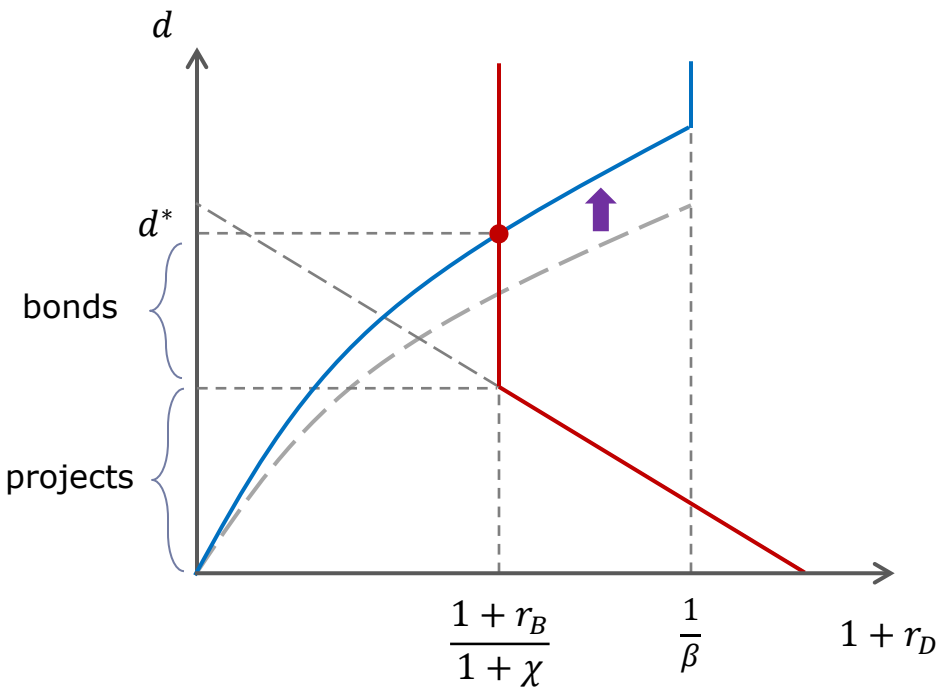
Equilibrium

- Deposits d^* determined by supply = demand
- Projects are funded if $\mathbb{E}[R_i] \geq (1 + r_B)$ (constrained efficient)
- Note: the money supply (d^*) has two components
  - part is backed by projects
    - "inside" money
  - part is backed by govt bonds
    - "outside" money
- Model offers a theory of the *composition* of money supply
  - as in Lagos & Rocheteau (2008)



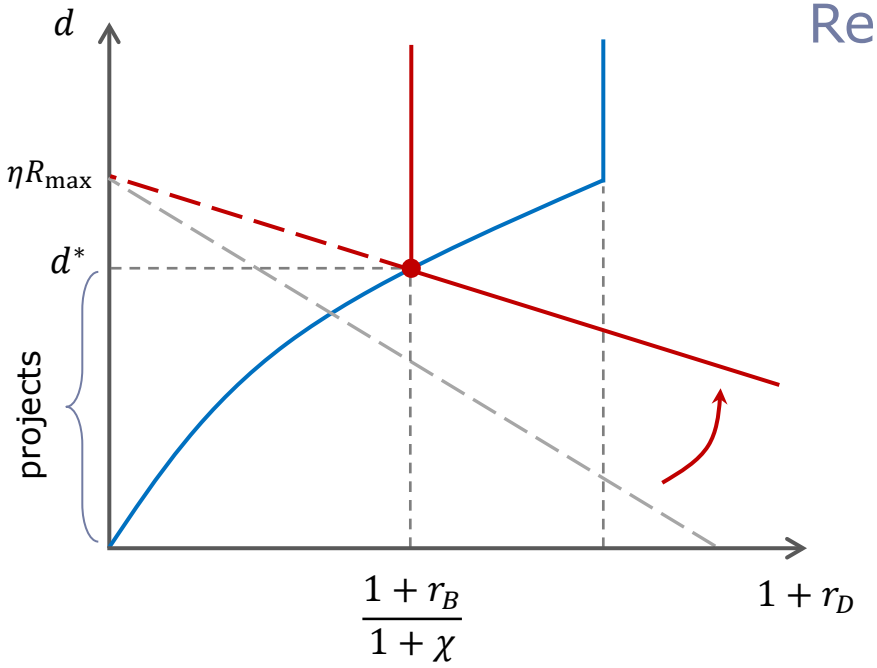
Digitalization

- Suppose the demand for deposits increases
  - story: households shift away from currency into deposits
  - assume currency is backed by govt bonds (outside money)
- Result: new deposits go entirely into bonds
  - no change in projects
- A shift away from CB money …
- But no change in the assets backing money (currency + deposits)



Frictions

- Now suppose banks fail in the bad aggregate state
  - limited liability
  - deposits are insured → losses shifted to the public sector
- Bank will operate projects with: $(1-\sigma q)R_i \geq (1+r_D)(1+\chi)$



Results:

- more projects operated
  - some with $\mathbb{E}[R] < (1+r_B)$
- banks hold fewer bonds
  - zero in the case shown here
- deposits may ↔ or ↑

In other words

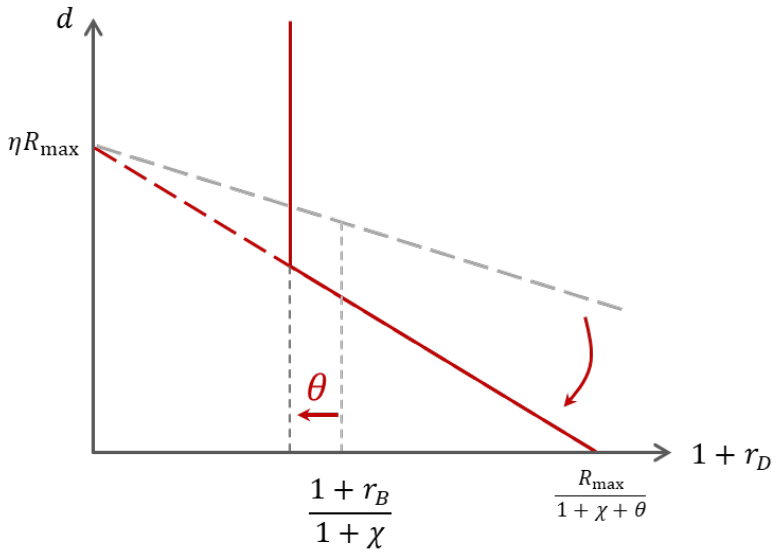
- Risk-shifting incentives change the *composition* of money
  - banks substitute inside money for outside money
    - by moving further down the risk/quality spectrum of projects
  - lowers aggregate welfare
- What should a policymaker in this environment do?

Regulation

- Banks are regulated precisely to prevent risk-shifting
  - suppose we impose a capital requirement or leverage ratio
  - in this simple model: additional cost of balance sheet size

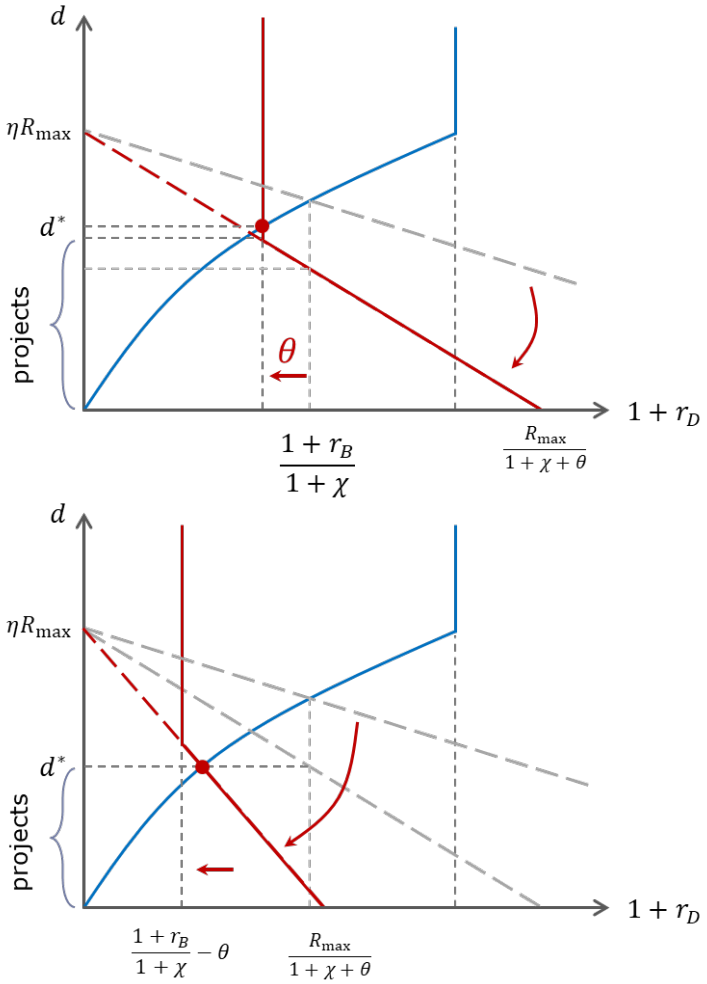
$$\mathbb{E}[\Pi] = \int_{\hat{R}}^{R_{\max}} \big((1-q)R_i + q(1-\sigma)R_i\big)dR_i + (1+r_B)b - (1+r_D)(1+\theta)d$$

- Banks will operate projects: $(1-\sigma q)R_i \geq (1+r_D)(1+\theta)(1+\chi)$
- Two effects:
  - fewer projects funded for any r_D
  - **and** the bond threshold shifts left



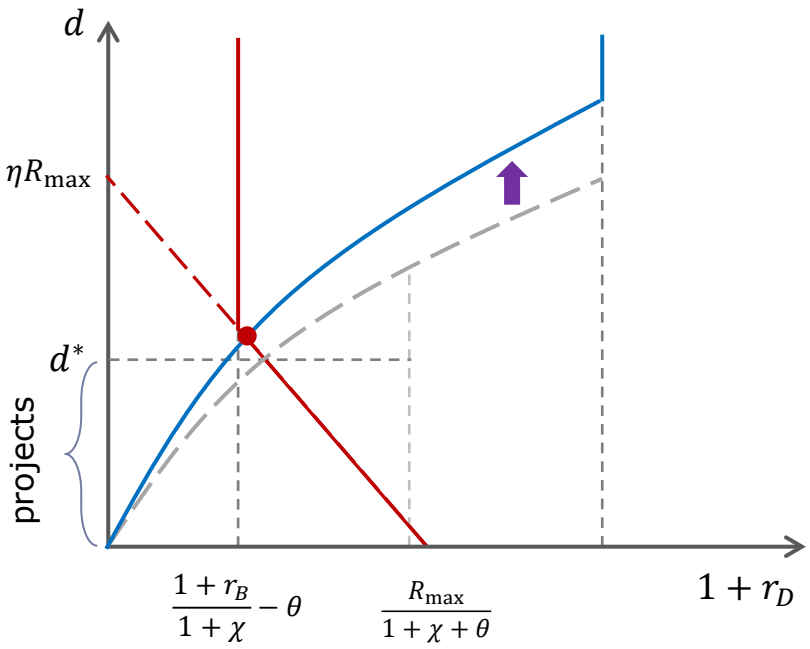
Equilibrium with regulation

- Regulation limits risk, but does not restore efficiency
- If θ just offsets the incentive distortion …
  - deposit rate falls
  - bank still operate too many projects; hold too few bonds
- A higher θ can lead to the correct investment cutoff
  - but then banks hold no bonds
- Problem: not enough (private) incentive to create outside money



Digitalization revisited

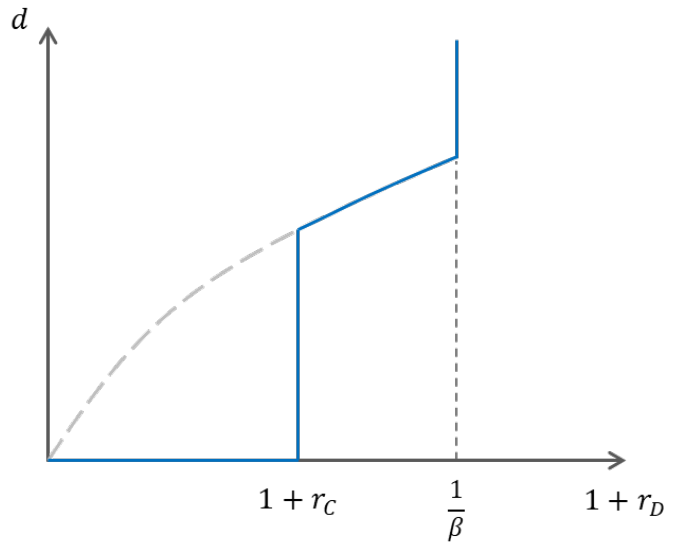
- If households shift from currency to deposits:
  - increase in demand causes $r_D \downarrow$
- Results:
  - more projects funded
    - outside money is exchanged for inside money
    - need to tighten regulation further
  - total money supply declines
    - bad for economic activity



- Recall: this event was neutral in the benchmark case

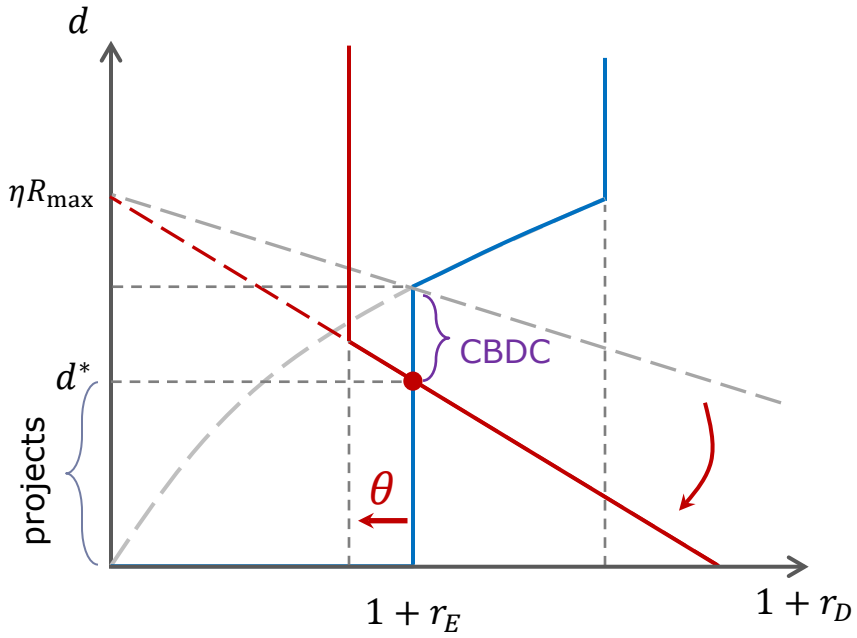
Adding CBDC

- How can we preserve a role for outside money?
  - in an environment where the demand for currency is decreasing
- Suppose the central bank creates CBDC by buying govt bonds
  - attractiveness of CBDC captured by interest rate $1 + r_C$
    - could also reflect privacy, other features
- Changes the demand for deposits
  - simple model: no demand below $1 + r_C$
  - could add heterogenous preferences, etc.



Equilibrium with CBDC

- Equilibrium returns to a mix of inside and outside money
  - banks specialize to inside money
  - households hold outside money directly (CBDC)
- Can choose (θ, r_E) to achieve the benchmark allocation
  - banks only fund socially-efficient projects
  - but large money balances …
    - deposits + CBDC
  - … support economic activity



Comments and caveats

- Can reserves play the role of CBDC here?
  - no. they are equivalent to bonds (Hu, 2021)
  - need households to hold outside money directly (Williamson, 2023)
    - or perhaps through *narrow banks*
- Perfect regulation could also achieve the benchmark allocation
  - here: risk-weighted capital requirement
  - in practice: perfect regulation/supervision is difficult
- CBDC affects the optimal capital requirement
  - here: lower (because ↑ in r_D mitigates incentive distortion)
  - in general: could go in either direction

Outline

- Motivation
- Payments
- Money
- Concluding remarks

Wrapping up

- Policy makers talk about "preserving a role for CB money"
  - may be important (but not in this model)
  - seems to be primarily about *payments*
- Model suggests: want to preserve a role for *outside money*
  - to control what assets benefit from the liquidity premium
  - otherwise, a shift away from currency will:
    - exacerbate the risk-shifting problem in banks
    - lead to tighter regulation, larger liquidity premium
- A well-designed CBDC can prevent these problems
- In other words …

- CBDC as a monetary asset …
  - which may pay interest, be held in substantial quantities
- …can be a (conservative?) response to a changing environment
- Policymakers may not want to start with this motivation
  - but … things change
- I believe we should continue to investigate CBDC broadly
- Many interesting open questions
  - interactions with bank regulation
  - CBDC vs. narrow banks (public vs. private incentives)
  - interaction of money and payments … and more