

*Conference on
The Future of the Monetary System*

CBDC: Money vs. Payments

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Outline

- ▶ Motivation
 - ▶ Payments
 - ▶ Money
 - ▶ Concluding remarks
-

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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.)

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- ▶ 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 ...
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- ▶ 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” $\nRightarrow$ we can ignore broader effects
 - ▶ Chiu & Davoodalhosseini (2023)

2) Things change. Sometimes very quickly

- ▶ in unusual times, unexpected changes occur, including in CB policy
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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

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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

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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

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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 $\approx$ 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
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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

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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

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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
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- ▶ 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)
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- ▶ 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

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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

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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

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- ▶ 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?

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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

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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

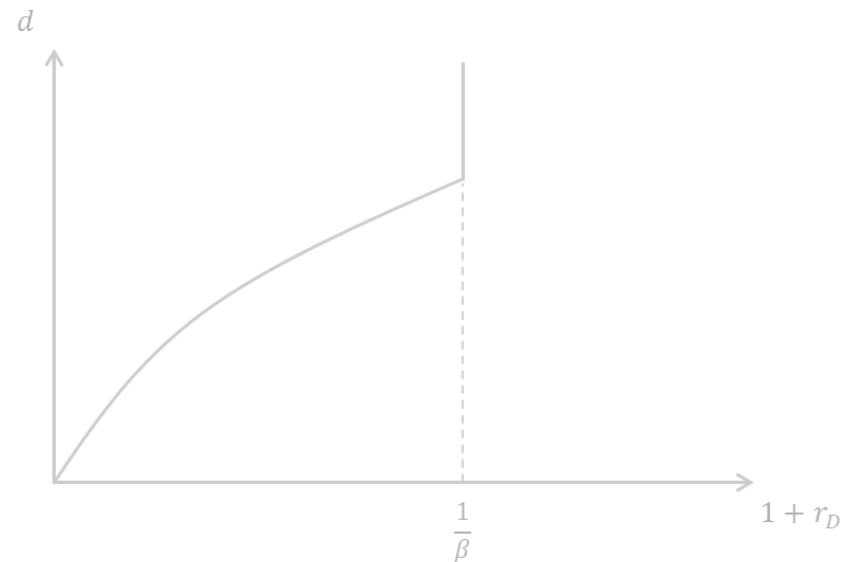
ease of use,
safety, etc.

- ▶ 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)

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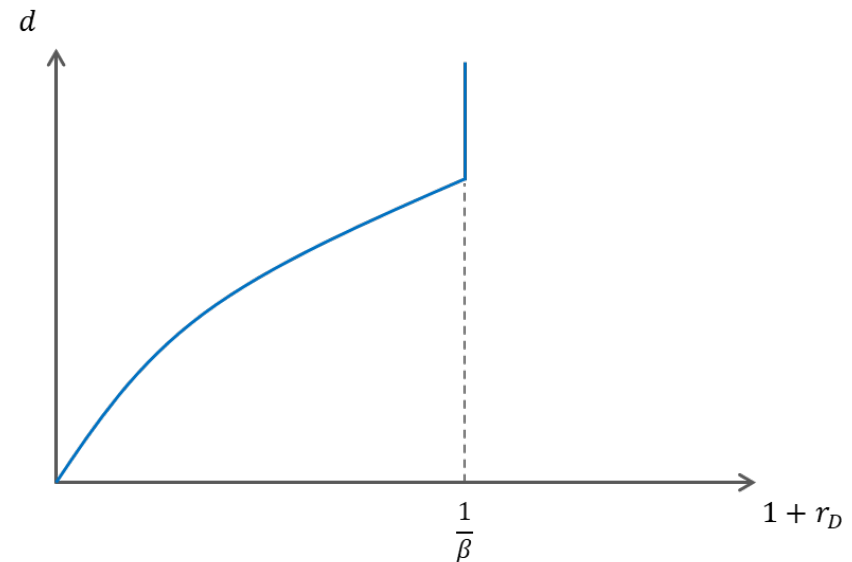
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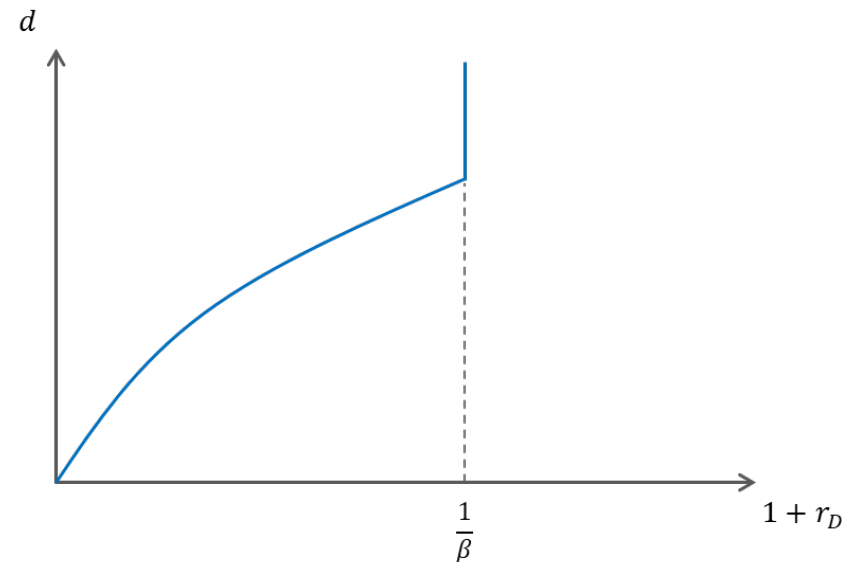
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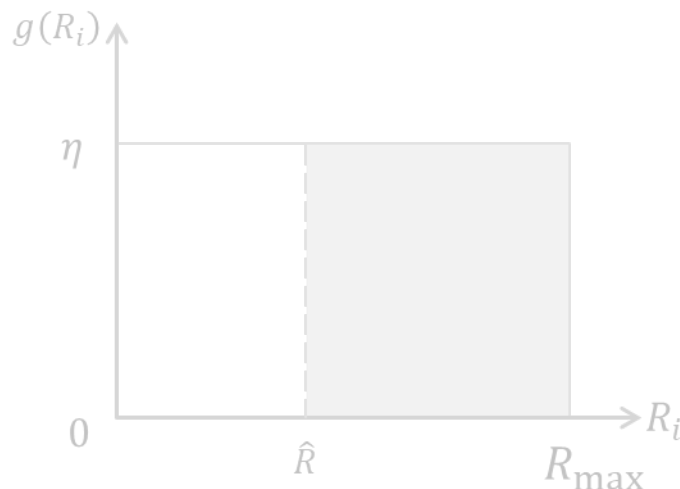
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Banks

- ▶ 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

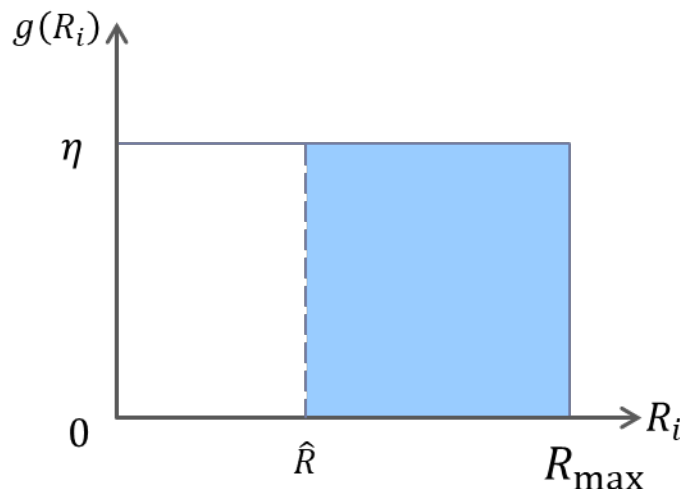


will fund all projects above
some cutoff $\hat{R}$

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

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 - ▶ 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:

$$\begin{aligned} \max_{\{\hat{R}, b, d\}} \quad & \int_{\hat{R}}^{R_{\max}} ((1 - q)R_i + q(1 - \sigma)R_i) dR_i + (1 + r_B)b - (1 + r_D)d \\ \text{s.t.} \quad & d = (1 + \chi)(R_{\max} - \hat{R} + b) \end{aligned}$$

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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
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A benchmark

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► If $(1+r_D) > \frac{1+r_B}{1+\chi}$:

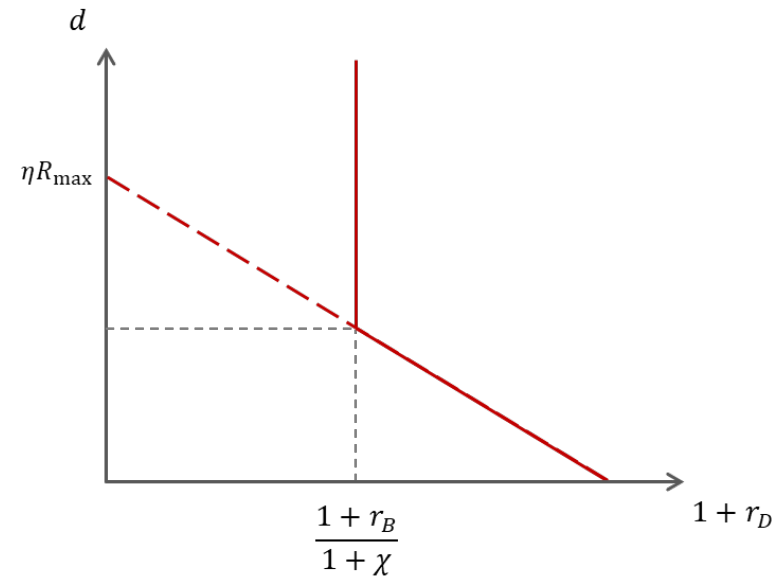
► set $b = 0$, operate projects with:

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supply of deposits

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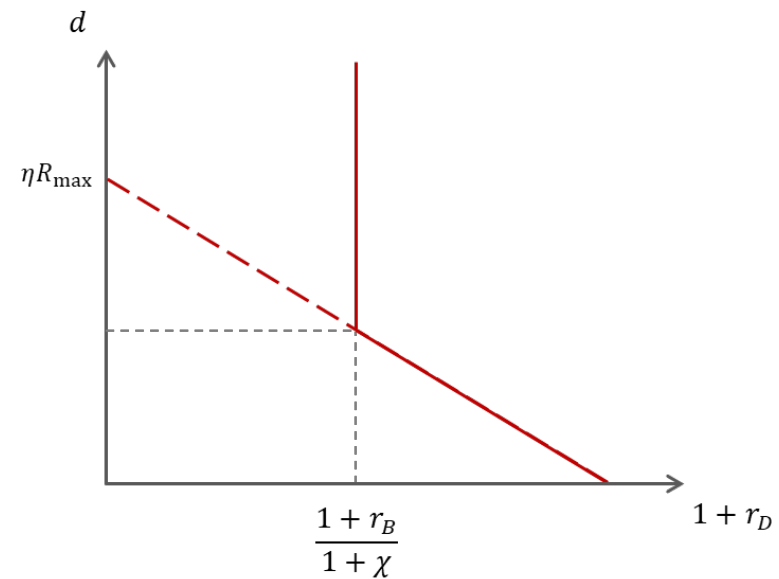
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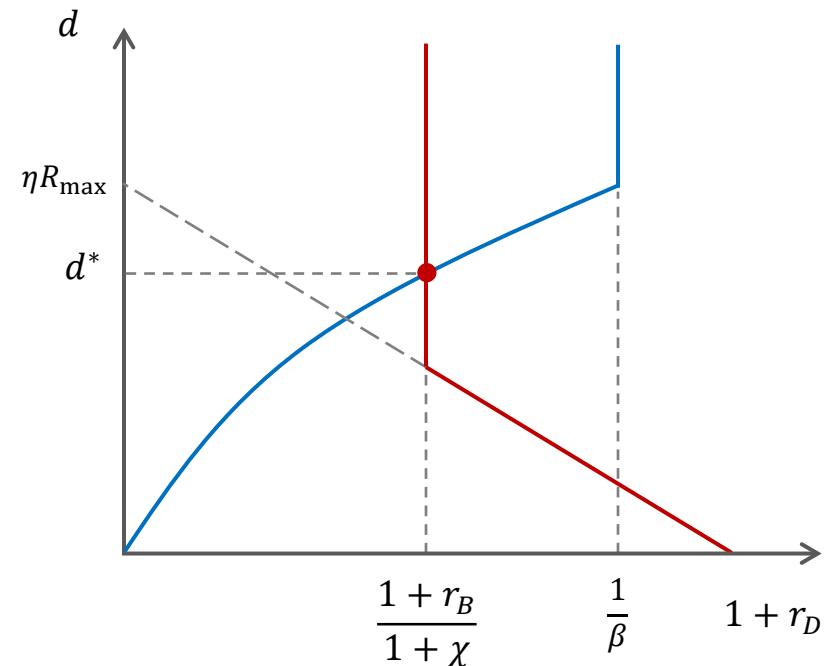
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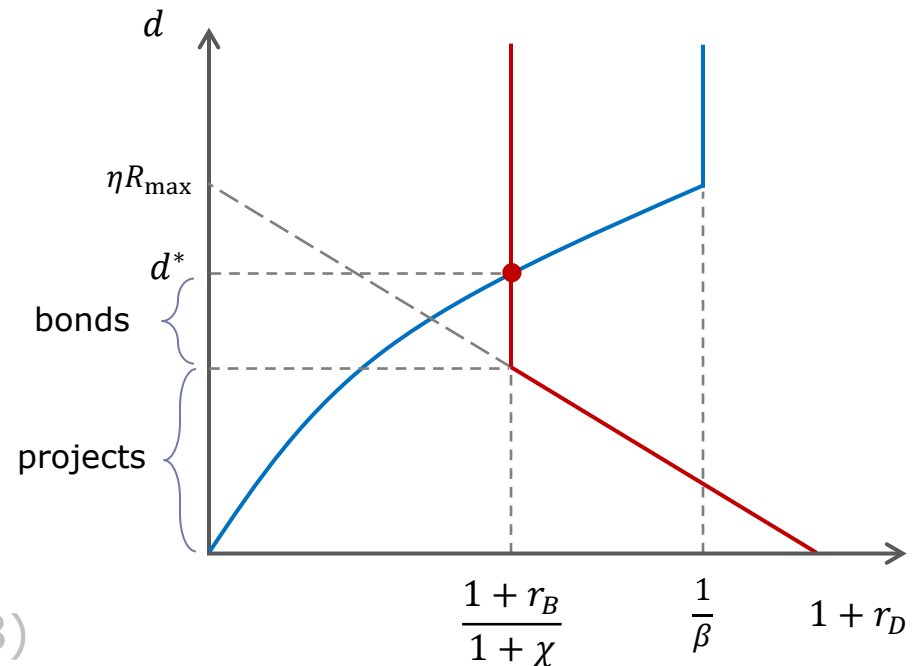
Equilibrium

- ▶ 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)



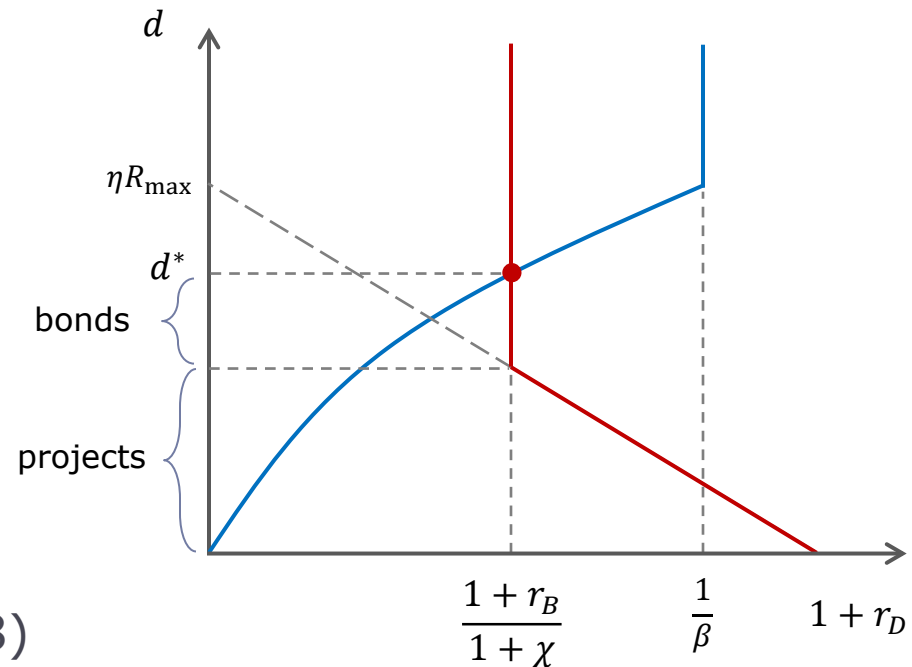
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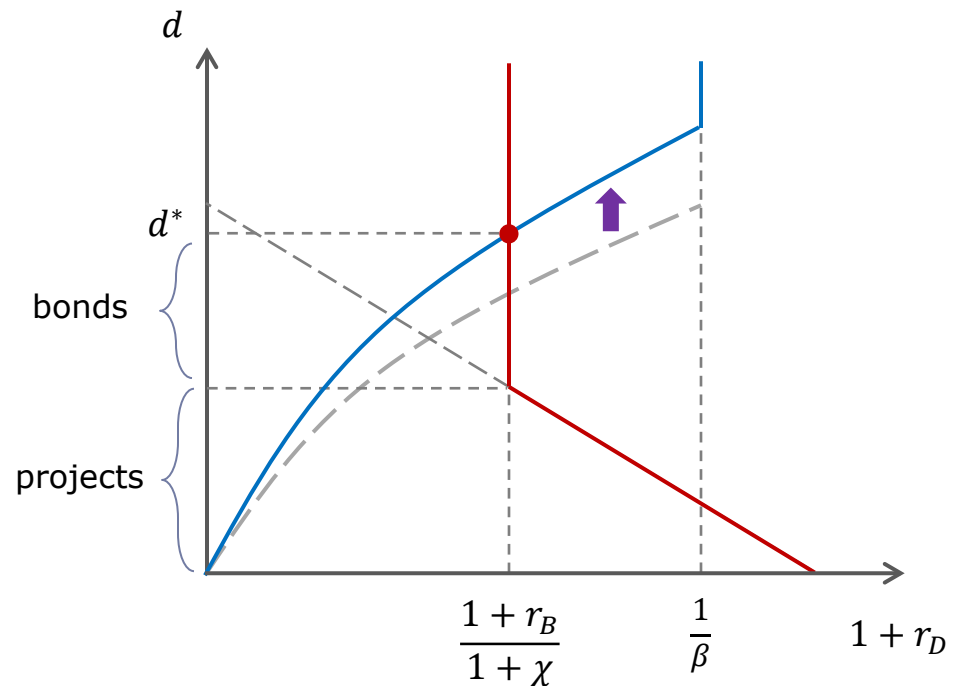
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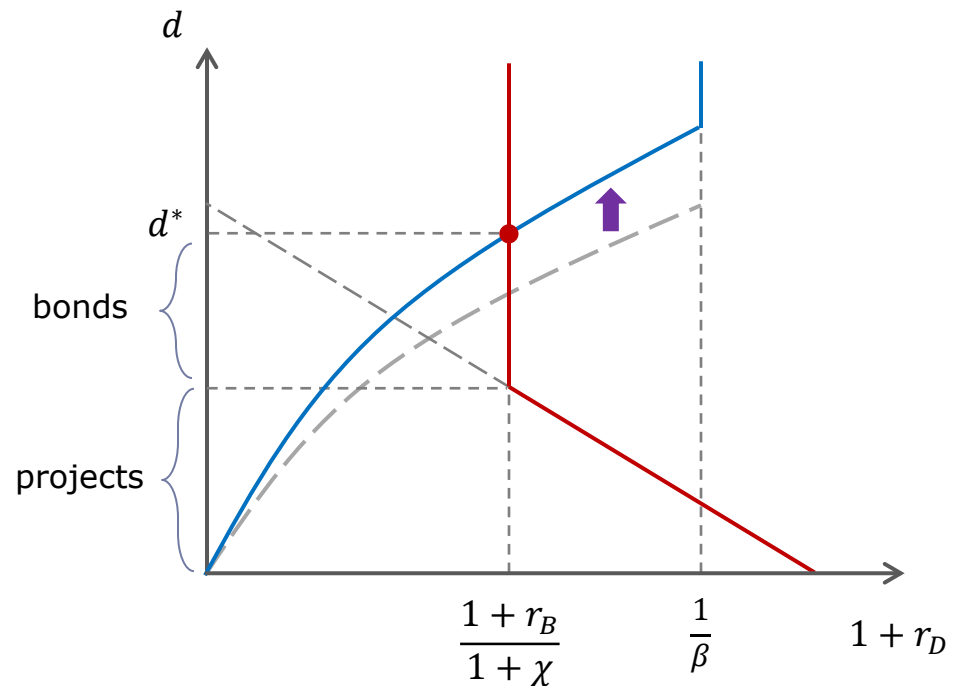
Digitalization

- ▶ 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)



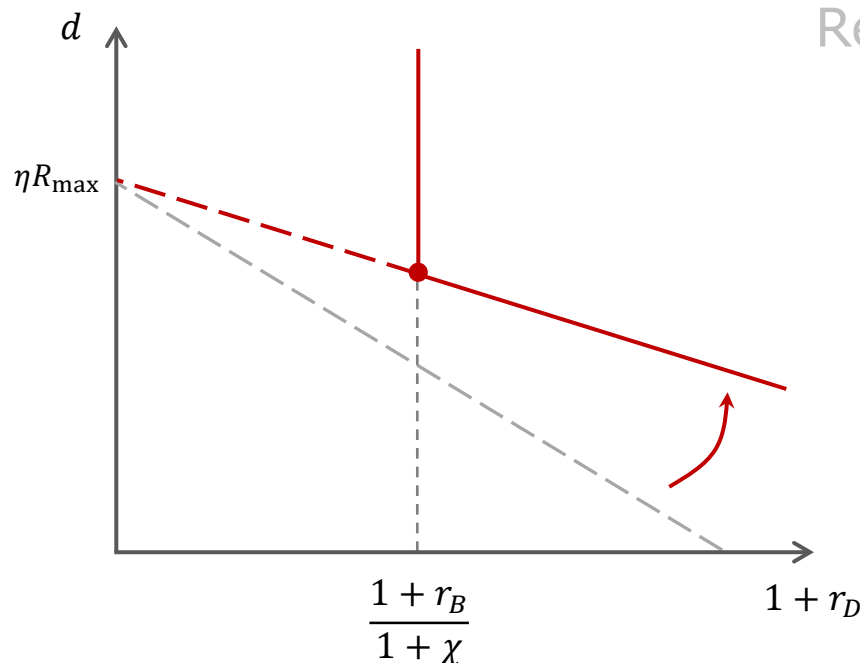
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Frictions

- ▶ Now suppose banks fail in the bad aggregate state
 - ▶ limited liability
 - ▶ deposits are insured $\rightarrow$ losses shifted to the public sector
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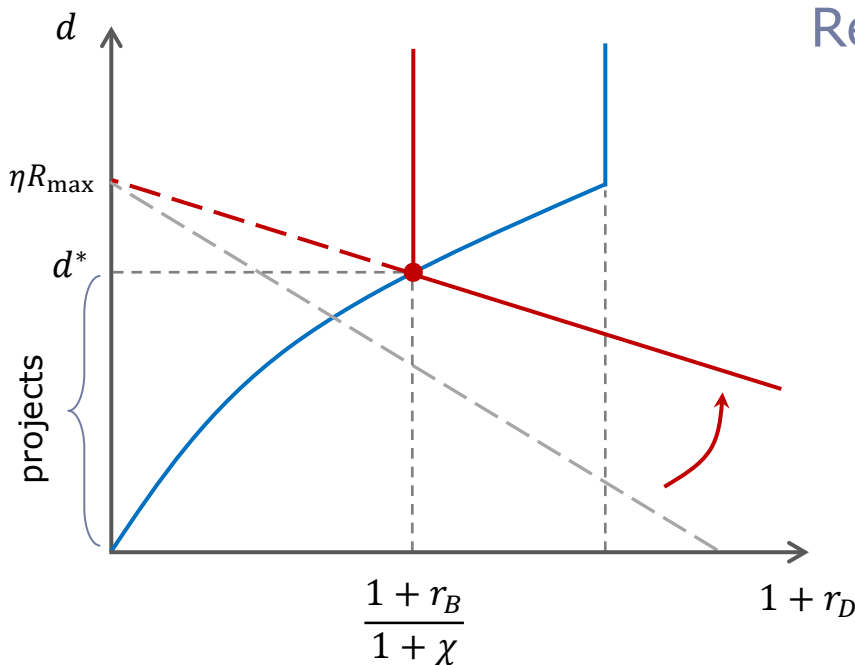


Results:

- ▶ more projects operated
 - ▶ some with $\mathbb{E}[R] < (1 + r_B)$
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In other words

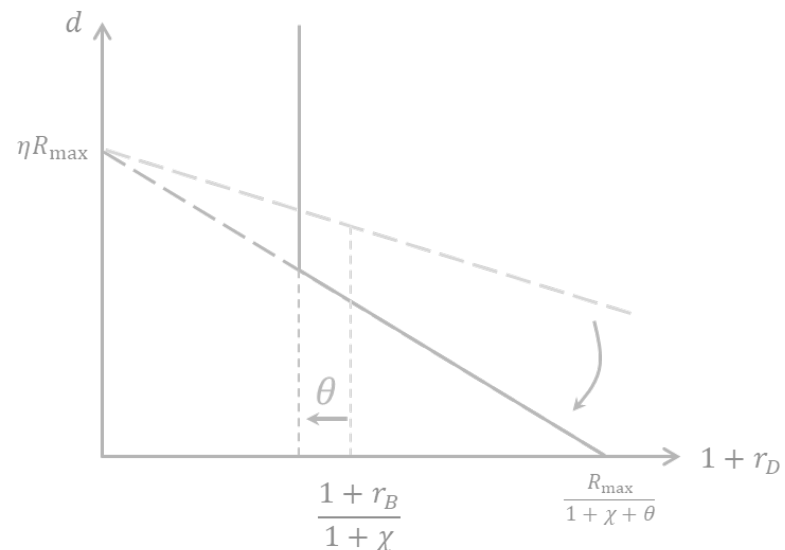
- ▶ Risk-shifting incentives change the *composition* of money
 - ▶ banks substitute inside money for outside money
 - ▶ by moving further down the risk/quality spectrum of projects
 - ▶ lowers aggregate welfare
- ▶ What should a policymaker in this environment do?

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

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

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 - ▶ fewer projects funded for any r_D
 - ▶ **and** the bond threshold shifts left



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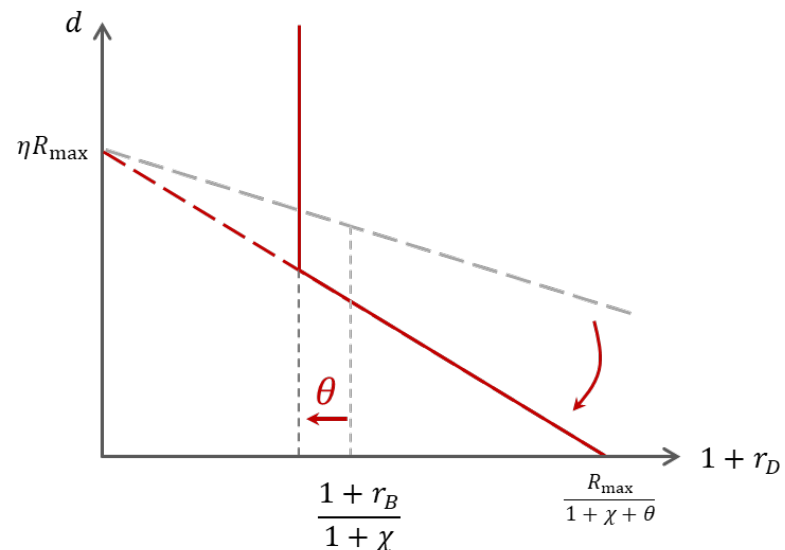
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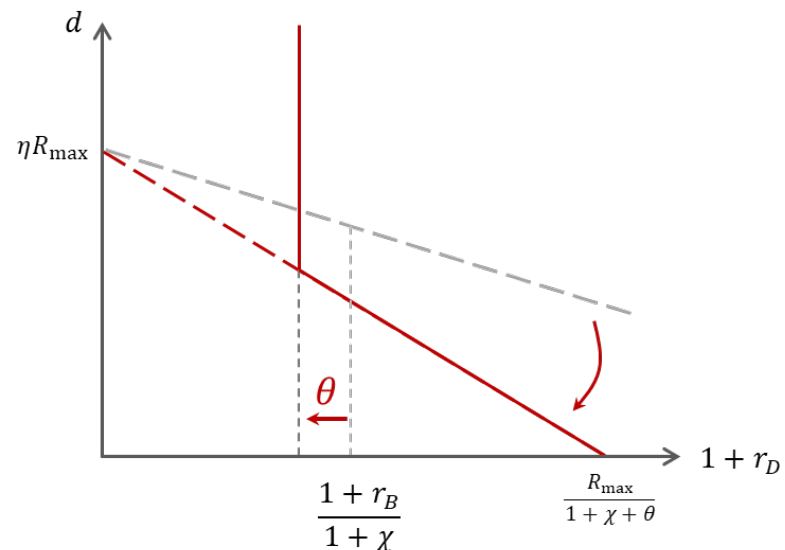


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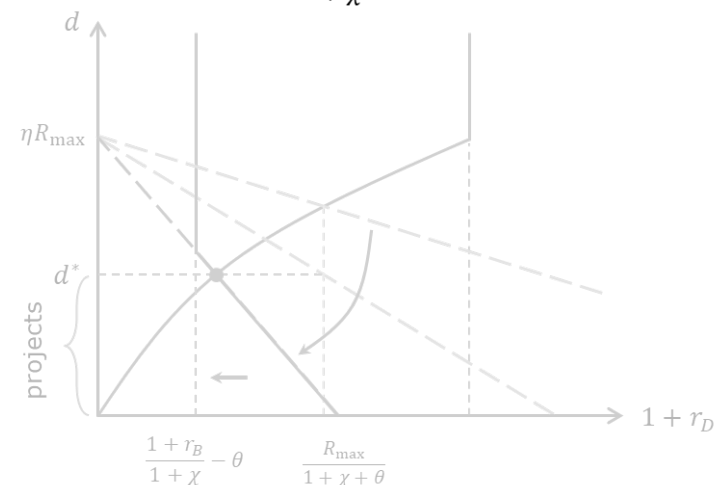
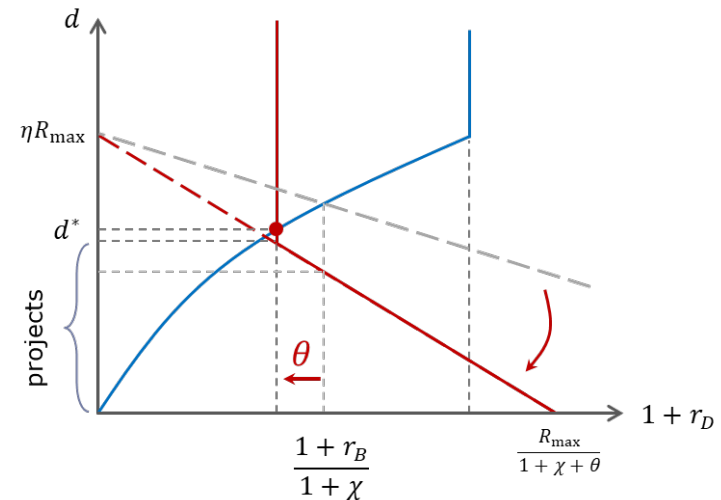
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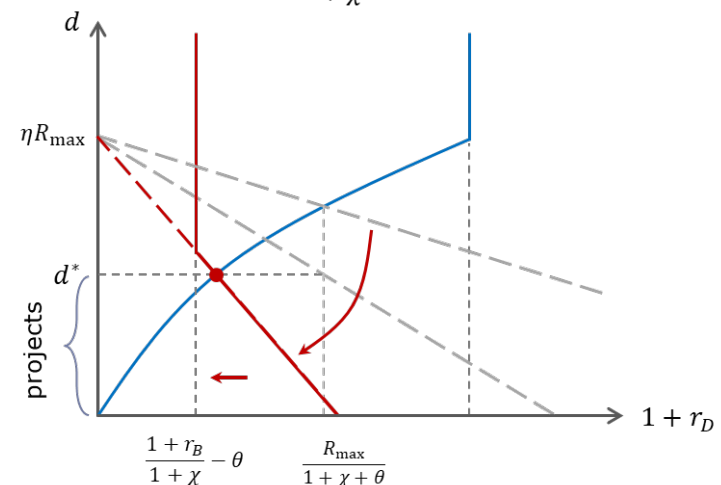
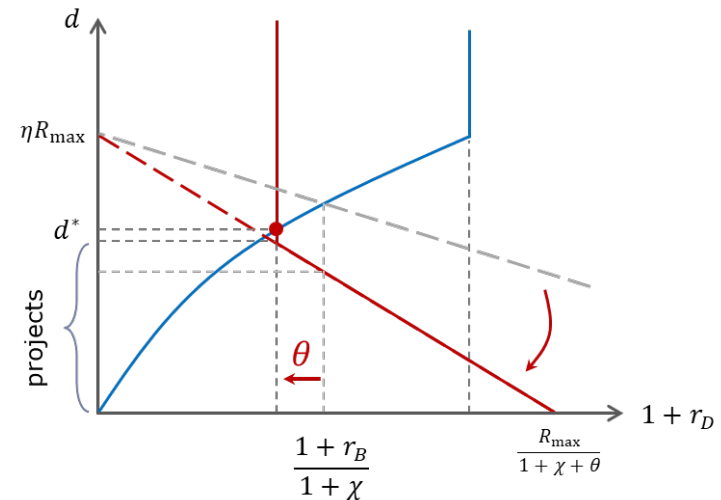
Equilibrium with regulation

- ▶ 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
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Digitalization revisited

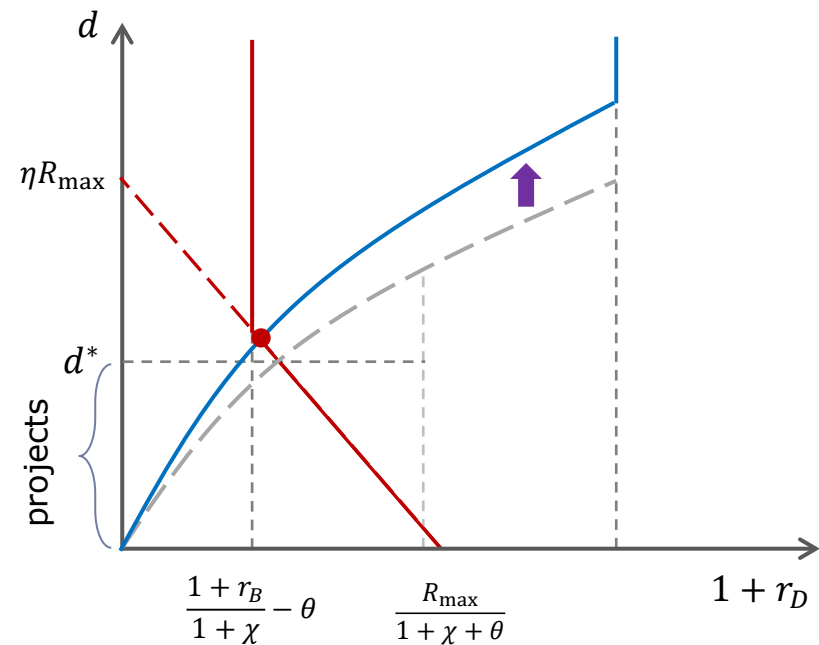
- ▶ If households shift from currency to deposits:

- ▶ increase in demand causes $r_D \downarrow$

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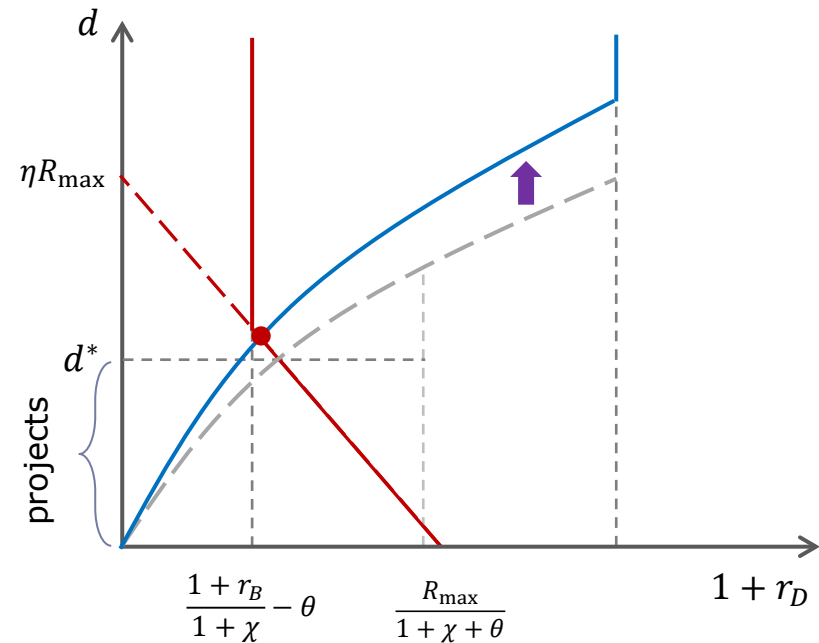
- ▶ more projects funded
 - ▶ outside money is exchanged for inside money
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 - ▶ total money supply declines
 - ▶ bad for economic activity

- ▶ Recall: this event was neutral in the benchmark case



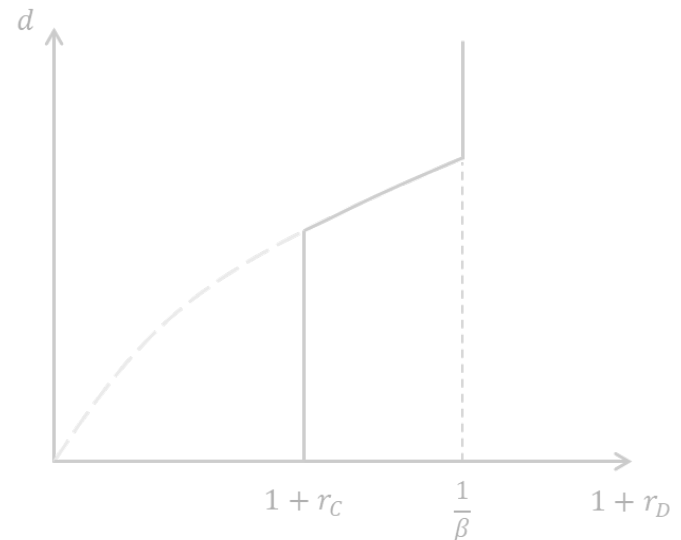
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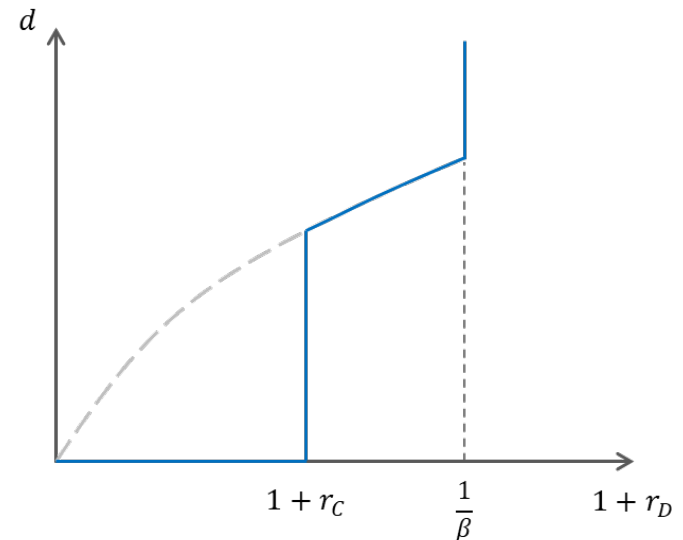
Adding CBDC

- ▶ 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 $1 + r_C$
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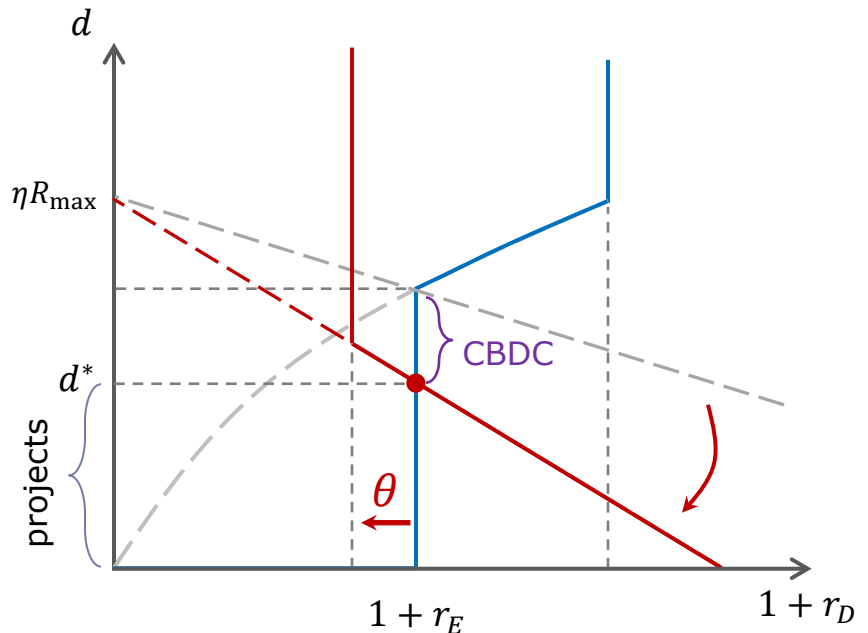
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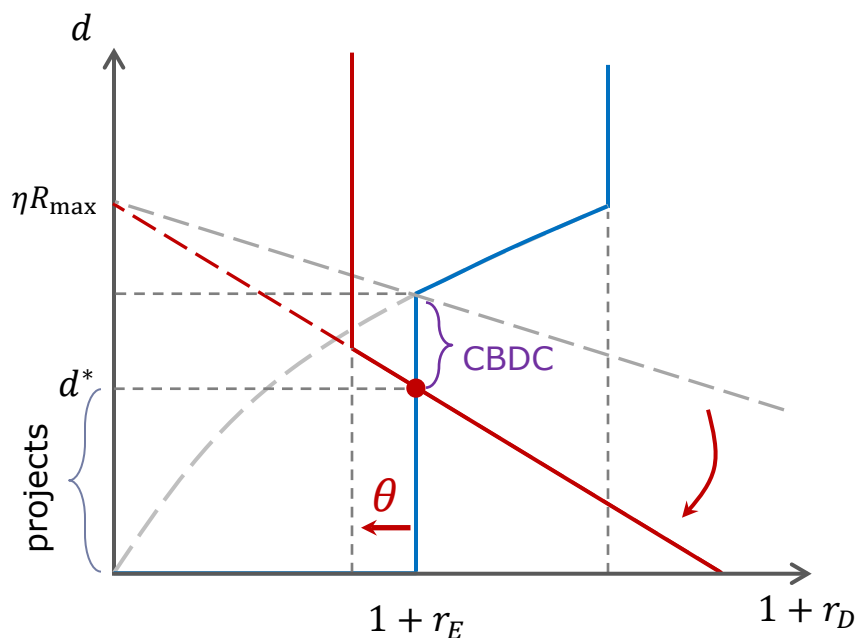
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 - ▶ banks only fund socially-efficient projects
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 - ▶ ... support economic activity



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Comments and caveats

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 - ▶ need households to hold outside money directly (Williamson, 2023)
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 - ▶ in practice: perfect regulation/supervision is difficult
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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
-

Thank you
