

# Should Central Banks Issue Digital Currency?

Todd Keister  
*Rutgers University*

Daniel Sanches  
*Federal Reserve Bank  
of Philadelphia*

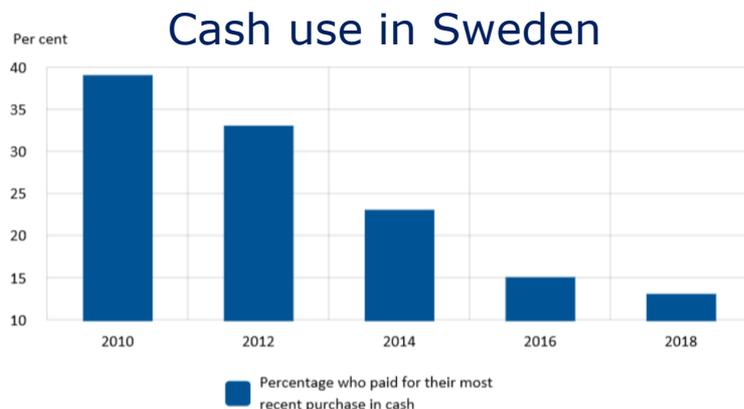
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# Money

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- ▶ Money (M1) has two distinct forms:
  - ▶ currency: a liability of the central bank, physical (paper)
  - ▶ bank deposits: a liability of private banks, → electronic



Source: Payments in Sweden 2019, Sveriges Riksbank

The shift toward electronic payments ...

... has implied a shift away from central bank liabilities and toward private liabilities

- ▶ Policy makers are concerned about consequences for:
  - ▶ contestability in payments markets
  - ▶ financial inclusion
  - ▶ monetary policy (esp. if private liability is in distinct units → Libra)

# CBDC

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- ▶ In response, some central banks are discussing issuing *digital currency* (CBDC)

	<u>Cash</u>	<u>Reserves</u>	<u>CBDC</u>
▶ a liability of the central bank	✓	✓	✓
▶ in electronic form	✗	✓	✓
▶ can be held by anyone	✓	✗	✓
▶ Could take one of several forms:			
▶ a cryptographic token ("FEDcoin")			
▶ or simply allowing individuals to have accounts at the central bank			
▶ perhaps with account services provided by private banks			
▶ or through a narrow bank holding 100% reserves ("synthetic CBDC")			
▶ BIS: 40+ central banks are studying the possibility of CBDC			

# One (major) concern

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- ▶ If many bank depositors shift to holding a CBDC instead...
  - ▶ how will that affect banks' funding costs?
  - ▶ bank lending? aggregate investment?

- ▶ 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)*

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Q: Is the possible disintermediation of banks a serious concern?

- ▶ specifically: is it a reason not to issue CBDC?
  - ▶ Disintermediating banks sounds bad, but ...
  - ▶ If a CBDC competes with bank deposits as medium of exchange ...
    - ▶ why isn't this competition a good thing?
  - ▶ If CBDC is an attractive medium of exchange, including bearing interest ...
    - ▶ seems like a way to implement Friedman's optimum quantity of money
- ⇒ The answer is not so obvious (→ need a model)

# What we do

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- ▶ Construct a model in which:
  - ▶ bank deposits are used as a medium of exchange
  - ▶ and therefore give banks a “low-cost source of funding”
    - ▶ “Taking Intermediation Seriously” (Smith, 2002)
- ▶ Introduce a CBDC into this environment
  - ▶ an alternative medium of exchange to bank deposits
  - ▶ pays interest at a rate chosen by the central bank
- ▶ Show that it does lead to “higher interest rates on bank loans”
- ▶ But can nevertheless raise output and welfare
  - ▶ emphasize that the interest rate on CBDC is a new policy tool

# Literature

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- ▶ There is a growing literature on the topic of CBDC
  - ▶ expository: Bech and Garratt (2017)
  - ▶ discussions: BIS (2018), Berentsen (2018), Bordo and Leven (2017), Engert and Fung (2017), Fung and Halaburda (2016), Kahn, Rivadeneyra and Wong (2018), Ketterer and Andrade (2016), and others
  - ▶ policy speeches: Broadbent (2016), Mersch (2017), others
  - ▶ plus BIS, IMF and central bank reports, many blog posts, etc.
  - ▶ models: Barrdear and Kumhof (2016), Davoodalhosseini (2018), Andolfatto (2019), Chiu et al. (2019), Williamson (2019)
- ▶ However, the basic macroeconomic impacts are still not well understood
  - ▶ research is still in the early phases

# Outline

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1. Introduction
2. Sketch of the model
3. Equilibrium (without CBDC)
4. Introducing CBDC
5. Results

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## 2. Sketch of the model

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# Setup

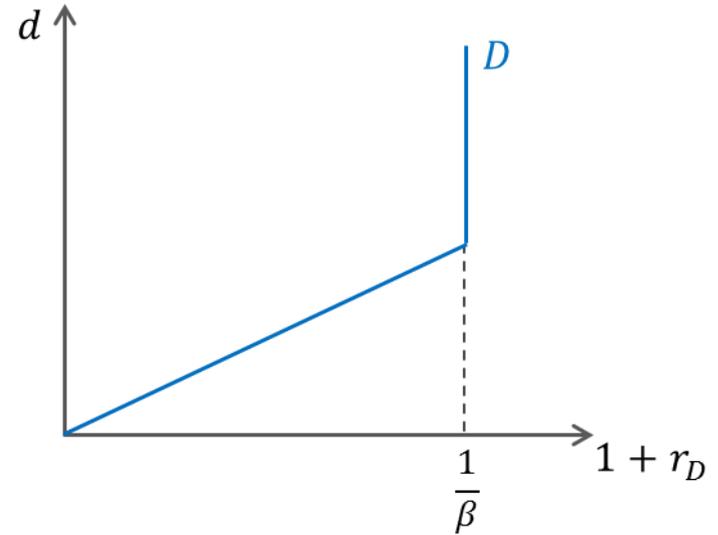
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- ▶ Dynamic GE model based on Lagos & Wright (2005)
  - ▶ why not overlapping generations with spatial separation and limited communication?
    - ▶ good question ...
- ▶ Types of agents
  - ▶ households            work; make purchases
  - ▶ firms                    invest and produce
  - ▶ banks                    intermediate between households and firms
  - ▶ central bank            issues currency    (consolidated public sector)
- ▶ I will focus on a few key features of the model
  - ▶ some misrepresentation; see the paper for full details
  - ▶ ignore paper currency (to save time)

# Households

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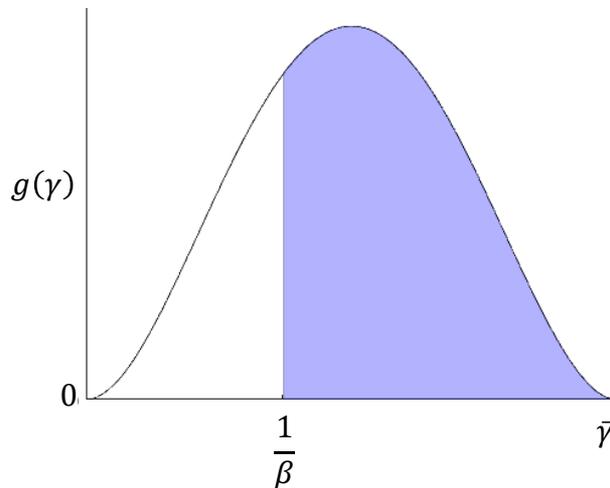
- ▶ Households use bank deposits to make purchases
- ▶ Choose a quantity  $d$  of deposits based on:
  - ▶ anticipated transaction needs and opportunities
  - ▶ and attractiveness of the medium of exchange
    - ▶ easiness of use, safety, etc.
- ▶ Focus on: interest rate  $1 + r_D$
- ▶ Deposit demand is:
  - ▶ increasing in  $1 + r_D$
  - ▶ vertical at  $1 + r_D = \frac{1}{\beta}$ 
    - ▶ because of quasi-linear preferences



# Firms

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- ▶ Firms have access to many different productive projects
  - ▶ each requires fixed input  $\rightarrow$  normalize to 1
  - ▶ generates output  $\gamma_j$  in the next period (heterogeneous)
  - ▶  $\gamma_j \sim [0, \bar{\gamma}]$  with cumulative distribution  $G$  and density function  $g$



$\Rightarrow$  diminishing returns to  
(aggregate) investment

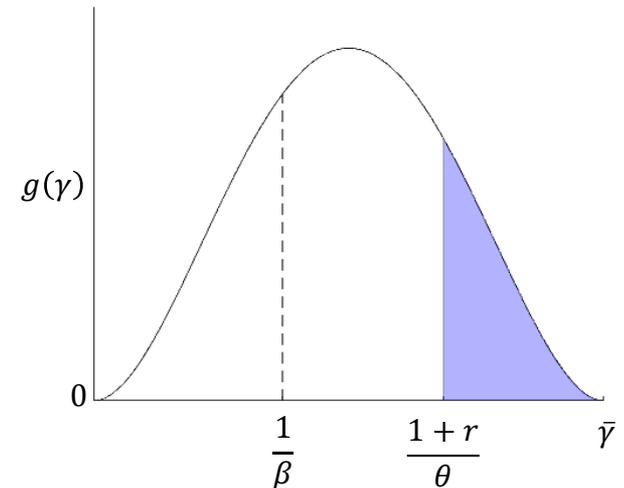
Efficiency: fund (only) those  
projects with  $\gamma_j > \frac{1}{\beta}$

- ▶ Firms must borrow to fund projects
  - ▶ interest rate on loan:  $1 + r_L \Rightarrow$  profit =  $\gamma_j - (1 + r_L)$

# Banks

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- ▶ Banks intermediate
  - ▶ issue deposits to households; make loans to firms
- ▶ Competition  $\Rightarrow r_L = r_D$
- ▶ Financial friction:
  - ▶ firm can only credibly pledge a fraction  $\theta$  of its output
    - ▶ as in Kiyotaki & Moore (1997), others
  - ▶ project  $j$  is funded if
$$1 + r_L \leq \theta \gamma_j$$
  - ▶ some profitable projects are not funded



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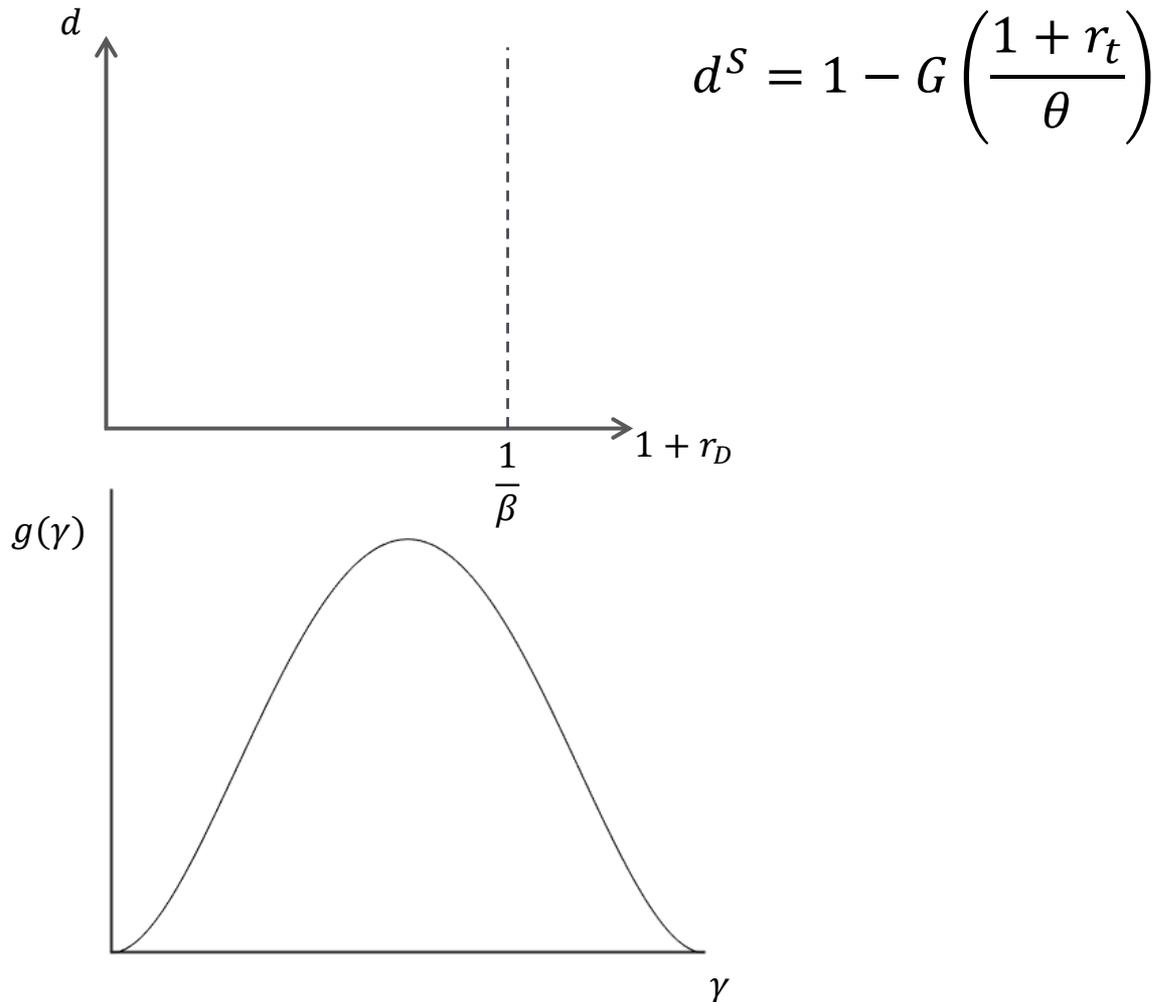
### 3. Equilibrium (without CBDC)

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# Supply of deposits

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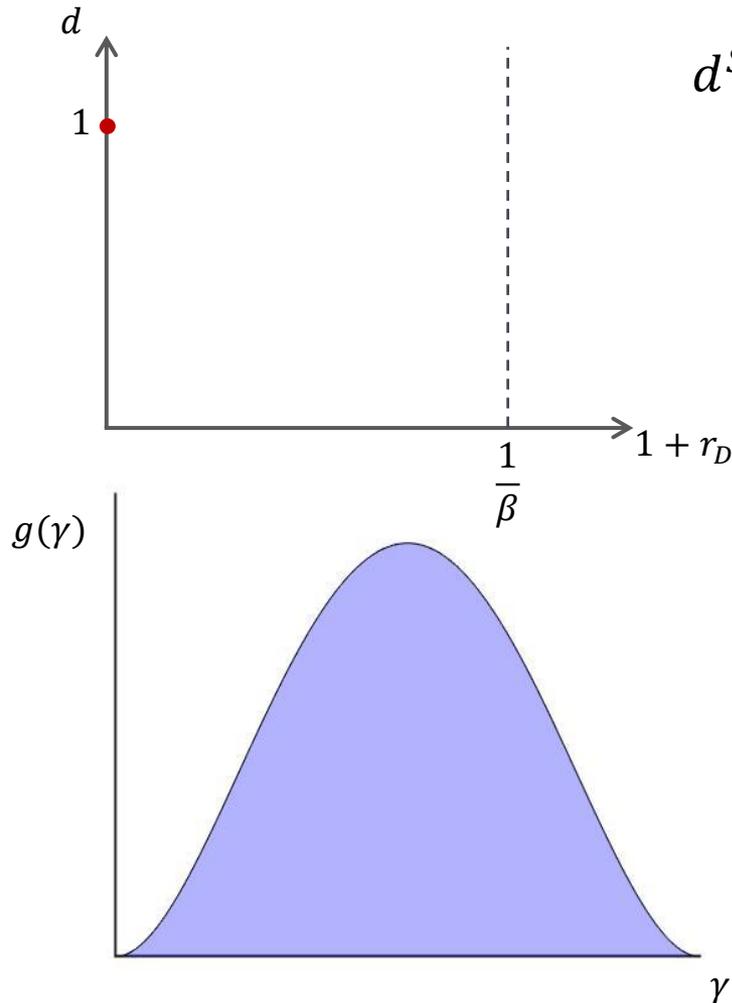
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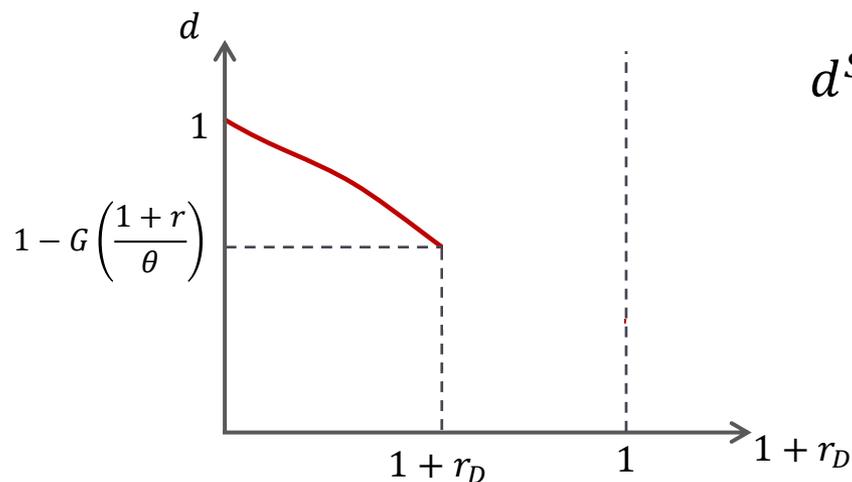


$$d^S = 1 - G\left(\frac{1 + r_t}{\theta}\right)$$

- ▶ When  $1 + r_t = 0 \Rightarrow$  all projects are funded
- ▶ supply of deposits is  $d^S = 1$

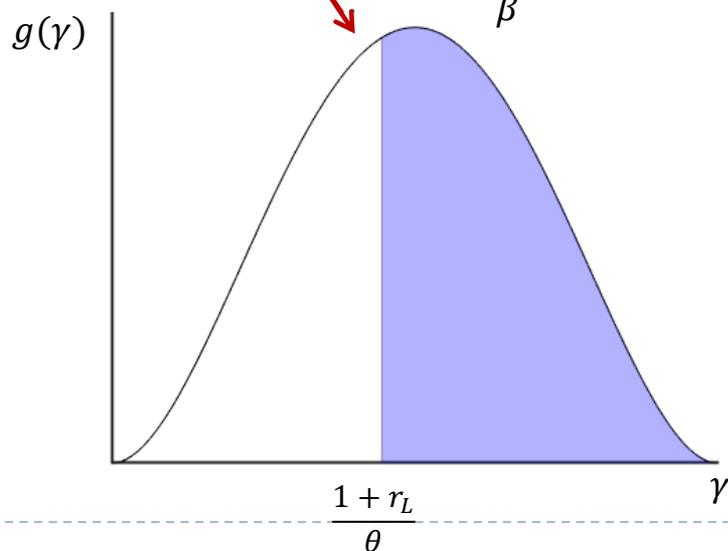
# Supply of deposits

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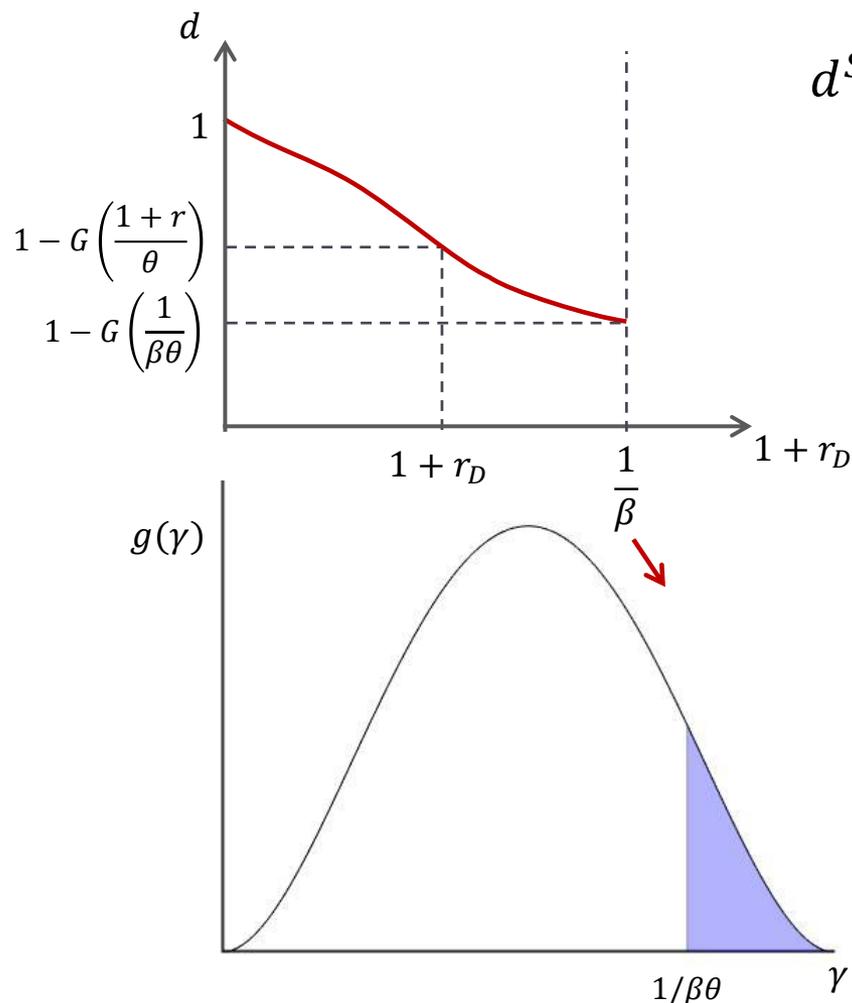
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- ▶ When  $1+r_t = 0 \Rightarrow$  all projects are funded
  - ▶ supply of deposits is  $d^S = 1$
- ▶ As  $r_t$  increases, fewer projects are viable
  - ▶ bankers issue fewer deposits



# Supply of deposits

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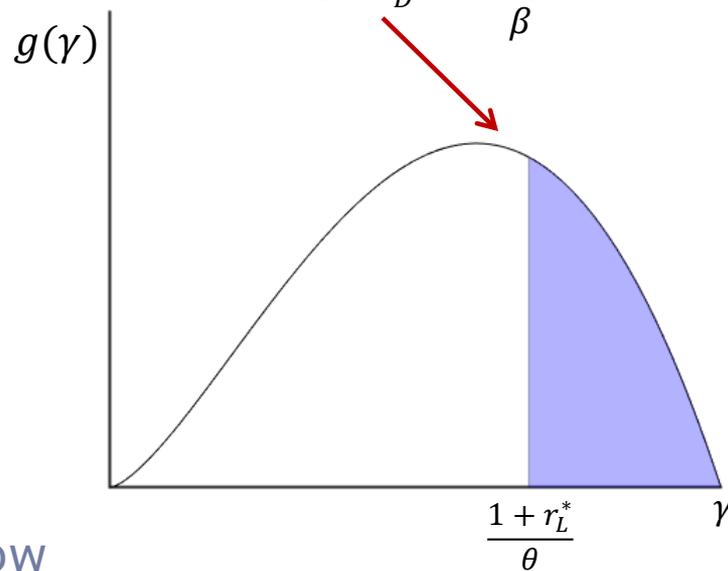
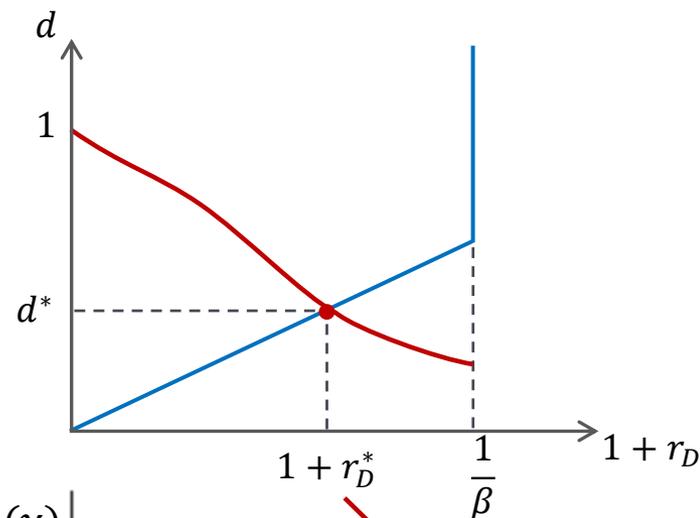
$\Rightarrow$  supply curve slopes downward

# Equilibrium

If high-return projects are scarce:

- ▶  $1 + r_D^* < \frac{1}{\beta}$  (liquidity premium)
  - ▶ deposits are “low-cost funding”
- ▶  $d^*$  small  $\rightarrow$  inefficient exchange (not pictured)
- ▶ Competition  $\rightarrow r_L^*$  low
  - ▶ low-cost funding passed to firms
  - ▶ which helps offset the  $\theta$  friction

Note: if  $\theta = 1 \Rightarrow$  investment cutoff is too low



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## 4. Introducing CBDC

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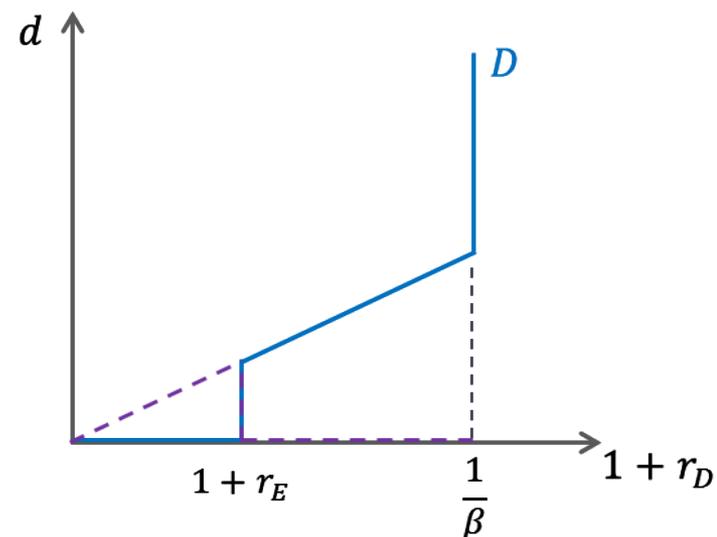
# What is a CBDC?

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- ▶ CBDC is a form of outside money that can potentially:
  - ▶ earn interest at rate  $r_E$  (positive or negative)
  - ▶ be used as a substitute for bank deposits
- ▶ Interest rate  $r_E$  places a lower bound on the deposit rate
  - ▶ if  $r_D < r_E$ : households hold no deposits
  - ▶ shift entirely into CBDC

Q: What are the equilibrium effects of introducing CBDC?

- ▶ how should the central bank set  $r_E$ ?

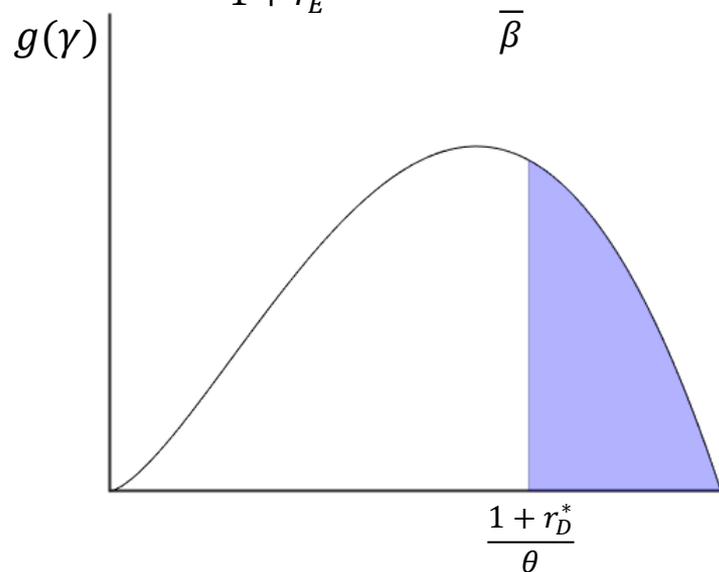
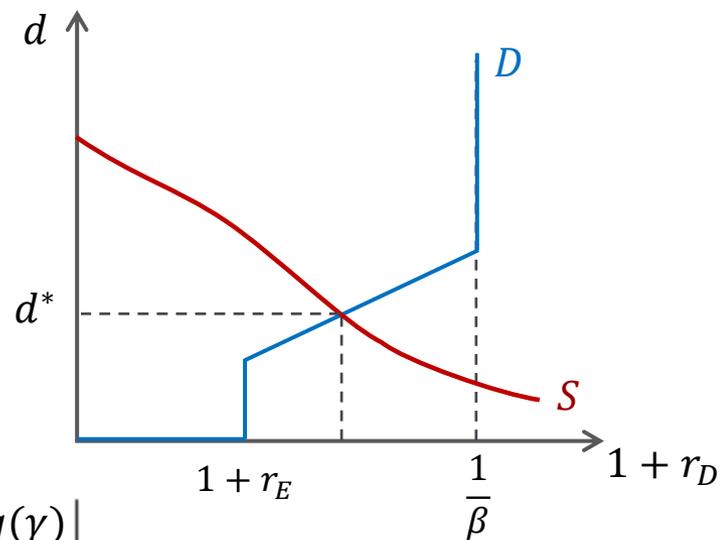


# Equilibrium with CBDC

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If  $r_E < r_D^*$ :

No effect on equilibrium



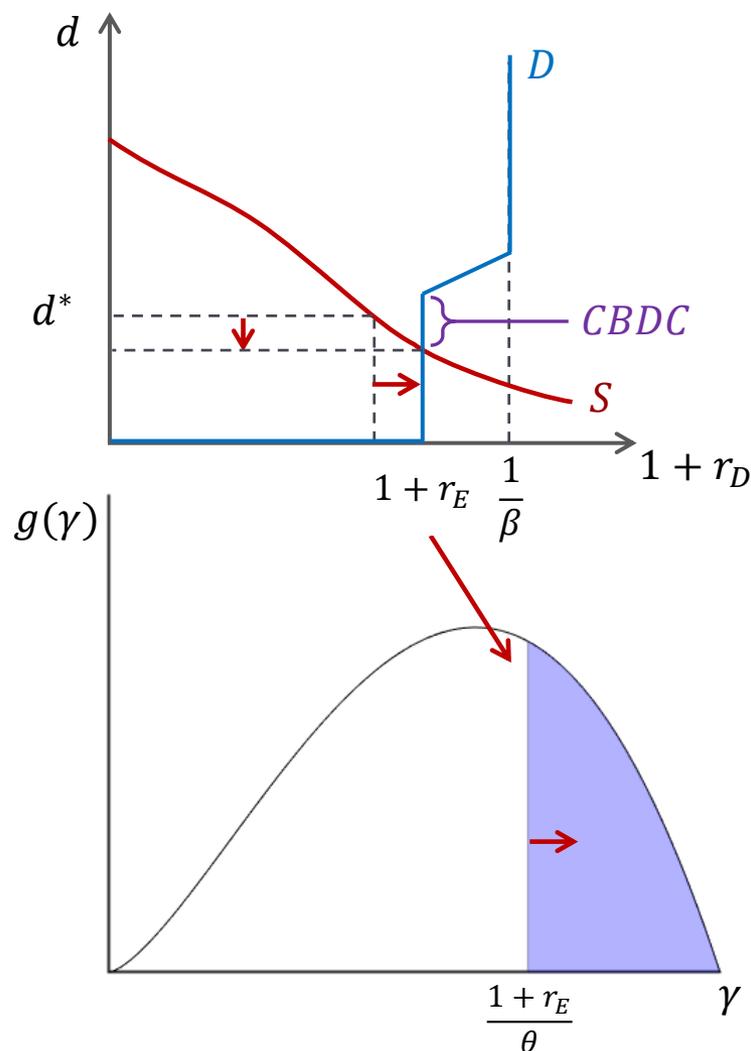
# Equilibrium with CBDC

If  $r_E > r_D^*$ :

- ▶ deposit rate increases to  $r_E$
- ▶ quantity of deposits falls
- ▶ investment cutoff  $\hat{\gamma}$  increases
  - ▶ quantity of bank lending falls

However:

- ▶ Total liquid balances (deposits plus CBDC) increase
- ⇒ increased in efficiency in exchange

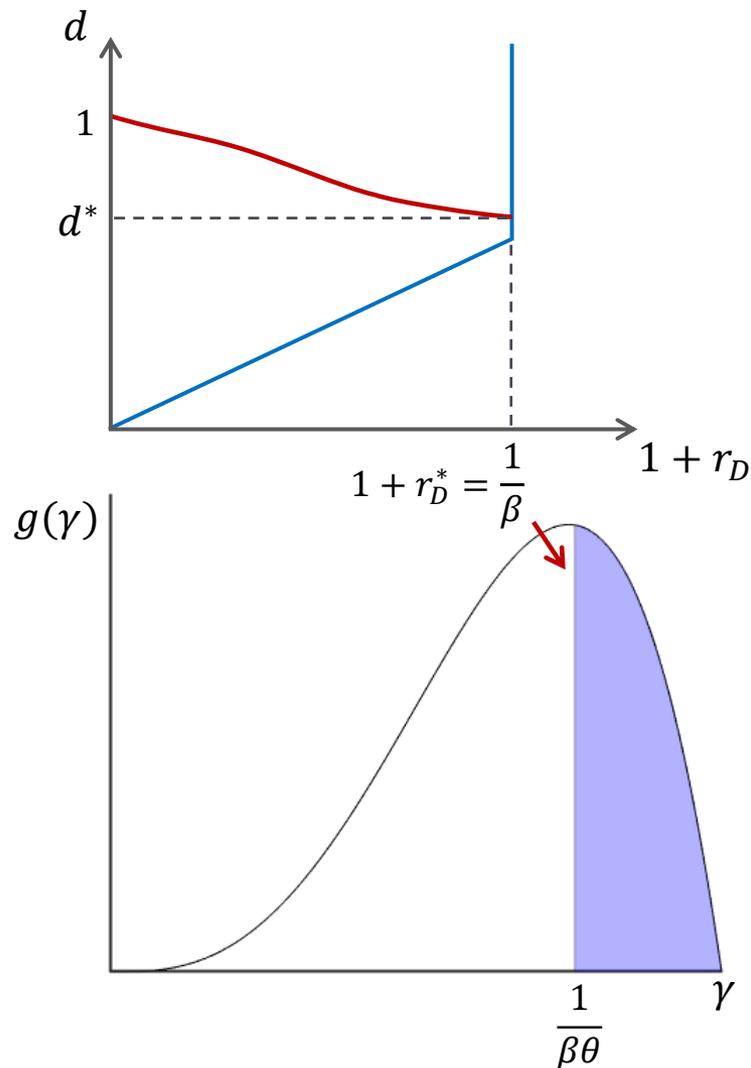


# Note

If high-return projects are plentiful:

- ▶  $1 + r_D^* = \frac{1}{\beta}$  (same as illiquid bond)
  - ▶ deposits are not low-cost funding
- ▶  $d^*$  is large  $\rightarrow$  efficient exchange (not pictured)
- ▶ No reason to set  $r_E > r_D^*$ 
  - ▶ in fact, CB cannot set  $r_E > r_D^*$

In this environment,  
disintermediation is not a concern



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# 5. Results

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# Results

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- ▶ If CDBC is held, both  $r_D$  and  $r_L$  increase
  - ▶ banks deposits decrease, and so does bank lending
  - ⇒ we have constructed a model in which the 'disintermediation' concern arises

However:

- ▶ The increase in  $r_L$  lowers welfare only if  $\theta < 1$ 
  - ▶ with no financial frictions, any disintermediation is good
  - ▶ and there may be other (better) ways to address financial frictions
- ▶ Even when  $\theta < 1$  ...

- 
- ▶ The increase in  $r_D$  brings real economic benefits
    - ▶ closer to optimum quantity of money (Friedman)
    - ▶ increases the demand for goods from households
  - ▶ If banks have market power, these benefits are larger
    - ▶ CBDC can reduce bank profits  $\Rightarrow r_L$  does not increase with  $r_D$ 
      - ▶ Andolfatto (2018)
    - ▶ CBDC can reduce monopoly pricing distortions
      - ▶ Chiu et al (2019)
  - ▶ CB can manage the disintermediation tradeoff using  $r_E$ 
    - ▶ a new (and useful) policy tool for managing 'aggregate liquidity'

# Central bank lending

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Q: Could we have the benefits of CBDC with no disintermediation?

- ▶ When it issues CBDC, the central bank receives goods
- ▶ Suppose it lends these goods in the deposit market
  - ▶ aiming to replace the funding lost by banks to the CBDC
- ▶ Could it decrease the liquidity premium ...
  - ▶ without decreasing the level of bank lending?

A: No.

- ▶ when CBDC is held,  $r_E = r_D = r_L$  determines what projects are viable
- ▶ central bank lending crowds out private deposits one-for-one
  - ▶ leaving total bank deposits, lending unchanged

# Conclusion

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## Bottom line:

- ▶ When  $r_E$  is chosen appropriately, CBDC never lowers welfare
  - ▶ often strictly increases welfare

## Implication:

- ▶ Need to include the ability to pay interest in CBDC design
  - ▶ in our model: optimal  $i^e$  can be positive or negative
- ▶ Some policy makers propose hard-wiring  $i^e = 0$ 
  - ▶ a way to make CBDC more “cash-like”
  - ▶ however: in some cases, zero is an attractive return (see: Europe)
- ▶ A CBDC with  $i^e \equiv 0$  can easily decrease welfare