Should Central Banks Issue Digital Currency?

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The views expressed herein are those of the authors and do not reflect the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.
CBDC

- A *central bank digital currency* is:
  - a liability of the central bank: Cash ✔, Reserves ✔, CBDC ✔
  - in electronic form: Cash ✗, Reserves ✔, CBDC ✔
  - can be held by anyone: Cash ✔, Reserves ✗, CBDC ✔

- Our focus is not on crypto or blockchain *per se*:
  - a CBDC could be a cryptographic token (“FEDcoin”)
  - or it could simply be allowing 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
Why now?

- CBDC has been technologically feasible for many years
  - why is there suddenly so much interest?

1. Declining use of cash in transactions
   - concern in some countries that cash may disappear (Sweden)
   - desire to maintain contestability in payments markets

2. Prevent a shift into private crypto/digital currencies
   - see: policymakers’ reaction to Libra

3. Improve the effectiveness of monetary policy
   - if CBDC pays interest, more directly pass-through of policy changes
   - if cash is phased out, could remove lower bound on interest rates
One (major) concern

- If many bank depositors shift to 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)
Q: Is the possible disintermediation of banks a serious concern?

- specifically: is it a reason not to issue CBDC?

- Answer is not so obvious

- If a CBDC competes with bank deposits as medium of exchange ...

  “Why isn’t competition a good thing here?”

    Hansen (lunch yesterday)

- If CBDC is an attractive medium of exchange (incl. interest bearing) ...

  - seems like a way to implement Friedman’s optimum quantity of money
What we do

- Construct a model in which:
  - bank deposits are used as a medium of exchange
  - and therefore give banks a “low-cost source of funding”
  - banks make loans to productive firms

- Introduce a CBDC into this environment
  - an alternative medium of exchange to bank deposits
  - pays interest at a rate chosen by 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
There is a growing literature on the topic of CBDC

- 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 and IMF reports, many blog posts, etc.

However, the basic macroeconomic impacts are still not well understood

- research is still in the early phases
Outline

1. Introduction

2. Sketch of the model

3. Equilibrium (without CBDC)

4. Introducing CBDC

5. Results
2. Sketch of the model
Setup

- Dynamic GE model based on Lagos & Wright (2005)
  - some goods are traded in a centralized market
  - other goods are traded bilaterally
    - matching/information frictions ⇒ need for a medium of exchange

- 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
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
    - 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

- 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

- Banks intermediate
  - issue deposits to households; make loans to firms
- Competition \( r_L = r_D \)

Financial friction:
- firm can only credibly pledge a fraction \( \theta \) of its output
  - as in Kiyotaki & Moore (1997), others
- project \( j \) is funded if
  \[
  1 + r_L \leq \theta y_j
  \]
- some profitable projects will not be funded
3. Equilibrium (without CBDC)
Supply of deposits

- Supply of deposits depends on the distribution of projects

\[ d^S = 1 - G \left( \frac{1 + r_t}{\theta} \right) \]
Supply of deposits

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- When \( 1 + r_t = 0 \) \( \Rightarrow \) all projects are funded

- supply of deposits is \( d^S = 1 \)
Supply of deposits

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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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- When \( 1 + r_t = 0 \) ⇒ all projects are funded
  
  - supply of deposits is \( d^S = 1 \)

- As \( r_t \) increases, fewer projects are viable
  
  - bankers issue fewer deposits
  
  \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 → inefficient exchange
  (not pictured)
- Competition → \( r_L^* \) low
  - low-cost funding passed to firms
  - which helps offset the \( \theta \) friction

Note: if \( \theta = 1 \) ⇒ investment cutoff is too low
4. Introducing CBDC
What is a CBDC?

- 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
  - households will not hold any deposits if $r_D < r_E$

Q: What are the equilibrium effects of introducing CBDC?
- how should the central bank set $r_E$?
Equilibrium with CBDC

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**
  - \( \Rightarrow \) increased in efficiency in exchange
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 → efficient exchange
  (not pictured)
- No reason to set \(r_E > r_D^*\)

In this environment, disintermediation is not a concern
5. Results
Results

- 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 ⇒ $r_L$ does not increase with $r_D$
  - Andolfatto (2018)
- CBDC can reduce monopoly pricing distortions
  - Chiu et al (2019)

Central bank can manage any tradeoff using $r_E$
- a new (and useful) policy tool for managing ‘aggregate liquidity’
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