

# Central Bank Digital Currency and Flight to Safety

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<sup>1</sup>The opinions are the author's and do not necessarily reflect those of the Federal Reserve Board or its staff



## Question and why it matters

- ▶ What is the effect of designing CBDC as a safe asset in times of crisis on the incidence of crises?
- ▶ Concern that by designing CBDC to provide a safe harbor the central bank might encourage financial instability
  - ▶ similar concerns were raised against the Fed's reverse repurchase agreement (ON-RRP) facility in 2015.
  - ▶ the U.S. Postal Savings System (1911-67) was used as a fight-to-safety vehicle, leading to measurable outflows of deposits from commercial banks prior to federal deposit insurance (Schuster et al (2016))

# The model

Lagos-Wright (2005) with elements of Cavalcanti-Wallace (1999)

- ▶ buyers, sellers
  - ▶ buyers consume in the DM and produce in the CM
  - ▶ sellers consume in the CM and produce in the DM
  - ▶ have private trading histories
- ▶ banks
  - ▶ consume in the CM
  - ▶ have public trading histories if paying a fixed utils cost  $\gamma$
  - ▶ can issue and redeem deposit liabilities
  - ▶ redemption is subject to endogenous limited commitment

## Novel elements

- ▶ a buyer meets a seller who accepts only cash wp  $\rho$  and a seller who accepts only deposits (or CBDC in a panic) wp  $1 - \rho$
- ▶ when making deposits buyers do not know the type of meeting they will be in
- ▶ buyers value liquidity insurance with respect to the payment instrument they may need
- ▶ a deposit contract provides this insurance by allowing a buyer to withdraw cash at the time when the type of meeting is revealed to the buyer
- ▶ no sequential service constraint: in a panic cash is evenly split among total withdrawals

# Equilibria

## Standard sunspot equilibria

- ▶ if sunspot hits  $\alpha \in [0, 1]$  banks are expected to fail.
- ▶ Buyers do not know the identity of these  $\alpha$  failing banks.
- ▶ Fearing their bank might be among those  $\alpha$ , buyers withdraw cash even if they are in a meeting with a deposit taking seller
  - ▶ buyers store cash until the next period, at the cost of no consumption this period
  - ▶ not doing so means buyers risk not having access to consumption and store of value option if their bank defaults

Hence, if the probability of banks failing is sufficiently large, then it is a dominant strategy for buyers to panic.

## Equilibria

- ▶ Whether in equilibrium  $\alpha < 1$  or  $\alpha = 1$  depends on the nominal interest rate  $R^b$ , among other things.
- ▶ If  $R^b$  is high enough then buyers expect little cash available at the bank in a run
  - ▶ with high  $R^b$ , the bank's portfolio decision is tilted away from cash (which returns zero)
  - ▶ buyers expect a relatively low payoff were they to withdraw their deposits in a run.
  - ▶ Hence, high interest rate can eliminate panics but at the cost of distorting banks' cash holdings away from the Friedman rule.
- ▶ Notice: the assumption of bilateral trade is key. In a Walrasian goods' market the price would drop with little cash available to be traded –because there is no real shock

## Central bank crisis interventions

1. Crisis lending to viable banks during a panic
  - ▶ the central bank knows the identities of the  $\alpha$  banks expected to fail when the sunspot hits
  - ▶ the central bank only lends to a bank who will repay
    - ▶ then only  $1 - \alpha$  banks will receive a loan.
- ▶ The goal of this policy is NOT to prevent the panic but to improve welfare of buyers who are unable to consume –i.e. those buyers who will meet a seller accepting only deposits.
- ▶ The optimal policy is the Friedman rule
  - ▶ banks are satiated with cash
  - ▶ no bank will take on a loan in equilibrium.

## Central bank crisis interventions

2. Crisis intervention through open market operations (OMO)
  - ▶ the central bank swaps, at face value, cash for government debt held by banks when the sunspot hits
  - ▶ The goal of this policy also is NOT to prevent the panic but to improve welfare of buyers who can't consume
  - ▶ With respect to crisis lending the open market facility is open to all banks rather than only the solvent ones
  - ▶ The optimal monetary policy is the Friedman rule
    - ▶ not to distort banks' portfolio allocation of cash and bonds
    - ▶ no bank will access the facility



## Central bank crisis interventions

- ▶ At the Friedman rule both policies are equivalent to the lack of intervention
- ▶ But both crisis interventions affect the existence of equilibria to encourage panics
  - ▶ there are economies where no equilibrium with the constructed strategies features panics in absence of crisis interventions
  - ▶ with crisis interventions there exist also panic equilibria

## Crisis interventions encouraging panics

OMO facility is worse than crisis lending as it allows coexistence of panics and no panic equilibria for a larger set of economies.

- ▶ This is due to two assumptions
  - (i) crisis lending is extended only to viable banks while in an OMO facility all banks can swap government bonds for cash
  - (ii) in an OMO intervention the swap of government bonds for cash is assumed to be done at face value
  
- ▶ Economic mechanism through incentive constraint of depositors after the realization of the sunspot

## Economic mechanism

Depositors' incentive to panic depends on the expected payoff of withdrawing relative to that of leaving funds in the bank

- ▶ if bank is viable the expected payoff of withdrawing is the same in the two interventions
- ▶ if bank is non-viable the expected payoff of withdrawing is lower with crisis lending than OMO
  - ▶ crisis lending is extended only to viable banks while OMO allows all banks to swap government bonds for cash
  - ▶ if an equilibrium without panics exists  $R^b$  must be high enough, distorting banks' portfolio decisions away from cash
  - ▶ with crisis lending this results in lower final payments to depositors of non-viable banks
  - ▶ with OMO bonds are swapped for cash at face value

## CBDC basics

- ▶ CBDC is a substitute for cash and for deposits *during a panic*
- ▶ CBDC provides partial insurance to depositors with respect to their liquidity needs when withdrawing CBDC during a panic.
- ▶ The characterization of equilibria same as the model with cash but differences with respect to the incidence of banking panics
  - ▶ CBDC is less disruptive of depositors' payment needs relative to an economy with cash
  - ▶ panics are not that bad with CBDC
  - ▶ a higher interest rate is necessary to implement an equilibrium in which panics do not occur

## CBDC and policy interventions

- ▶ Both facilities in economies with CBDC encourage panics as with cash
- ▶ The main novelty is that CBDC improves on payment systems by preventing panics from being disruptive to retail payments.
- ▶ Under all policy regimes CBDC
  - ▶ mitigates the damage done by a banking panic
  - ▶ its use gives rise to economies where welfare is higher in a panic equilibrium than in the equilibrium with no panic

## CBDC and welfare in panic equilibria

Economic mechanism:

- ▶ a no panic equilibrium requires a high interest rate  $R^b$
- ▶ high  $R^b$  distorts banks' portfolio allocation between CBDC and bonds holdings away from CBDC and towards bonds
- ▶ high  $R^b$  distorts depositors' consumption away from first best
- ▶ in a panic equilibrium all depositor can trade with a seller and consume, regardless of the type of meeting

## Optimal government policy

- ▶ The interventions analyzed NOT aimed at tackling the root of the problem:
  - ▶ steering depositors' beliefs away from fearing their bank will fail when the sunspot hits
- ▶ Consider a policy of bailout of the  $\alpha$  banks believed to fail
  - ▶ i.e. raising enough resources (i.e. CM good) to make a transfer to all the holders of deposits issued by the  $\alpha$  failing banks

## Banks' bailout

- ▶ Feasible policy as
  - (i) lump sum taxes allowed in the model
  - (ii) central bank knows the identities of the inactive banks before depositors can withdraw
- ▶ depositors have no incentive to run on the banks, as deposits are honored (by the government) were the banks to fail
- ▶ banks would have no incentive to default on their liabilities, as depositors are not panicking
- ▶ the key features of the model economy permit arrangements aimed at preventing the panic rather than responding to it

If depositors lack commitment also with respect to tax payments then policies involving transfers might not be implementable



## Private arrangements

Banks' clearing houses: voluntary organization of banks in supporting each others' liabilities via insurance pools

- ▶ have been observed in the monetary history of the U.S. during the National Banking Era (1864-1912)
- ▶ Essentially banks tried to set up an alternative payment system as they realized that the status quo would collapse.
- ▶ Even with depositors lacking commitment to pay taxes this arrangement which could prevent the panic from occurring

## Private arrangements

### Example:

- ▶ in the panic of 1907 *“banks formed associations (clearing houses) that issued certificates and their own checks, which were guaranteed by all the associated banks –hence risk pooling was present here– and these banks agreed to accept them at par for the sum named. [...] The autumn of 1907 witnessed an extensive and prolonged breakdown of the country’s credit mechanism [and] the ingenious invention of multifarious other substitutes for legal currency during the weeks of hoarding and suspension.”* Andrew (QJE 1908)

## Private arrangements

- ▶ Since FDIC was established in the U.S. following the Great Depression, we have not witnessed similar instances of voluntary banks' association
- ▶ But the Federal Reserve was designed to mimic the functioning of clearing houses during the National Banking Era
- ▶ it was perceived that the Fed's lender of last resort function made associations of banks into clearing houses unnecessary (Gorton (1984) and Gatch (2008))

The establishment of the Federal Reserve effectively crowded out banks' clearing houses

## Private arrangements

- ▶ Crucial to understand the distortion which certain policies introduce when crowding out private arrangements
- ▶ This model, with one of banks' (and other agents') distinguishing feature being endogenous limited commitment, seems perfect to study how these arrangements are affected by the introduction of alternative means of payment

## A modified version of this model

- ▶ Suppose banks choose to pay a fraction  $\phi \in [0, 1]$  of the deposits of the  $\alpha$  non-viable banks
- ▶ The limited commitment constraint of a viable bank  $i$  is

$$-(1 - \rho)d_t - \phi \frac{\alpha}{(1 - \alpha)} d_t^{-i} + v_{t+1} \geq 0$$

with  $\alpha d_t^{-i}$  denoting deposits issued by nonviable banks

- ▶ Hence, the continuation value of a viable bank (i.e. its expected lifetime profits) needs to be larger in order to support the equilibrium with no panic

## A modified version of this model

- ▶ Assume limited commitment constraint is slack (as in paper)
- ▶ Focus on how this voluntary arrangement affects depositors' incentive not to panic when the sunspot hits:

$$\frac{c}{\rho R^b} \leq (1 - \alpha)u(x^*) + \alpha u(\beta \phi d_t)$$

- ▶ A smaller lower bound on  $R^b$  necessary not to panic



a no panic equilibrium exists for a larger set of economies

## CBDC in the modified model

- ▶ Also in the modified model CBDC encourages panics
  - ▶ a panic with CBDC is not that bad
  - ▶ CBDC affects incentives not to panic by tightening the constraint (opposite effect than voluntary payments)

$$u\left(\frac{mR^m}{\rho R^b}\right) \leq (1 - \alpha)u(x^*) + \alpha u(\beta \phi d_t)$$

- ▶ The introduction of CBDC as a superior retail payment is similar to the establishment of the Federal Reserve as a superior check clearing system

## CBDC in the modified model

- ▶ The establishment of the Federal Reserve discouraged the effectiveness of private arrangements (clearing houses)
- ▶ The introduction of CBDC might have similar consequences
  - ▶ crowing out welfare improving private arrangements
- ▶ The potential for these consequences should be taken into account in the design of CBDC



## Destabilizing rather than disintermediating

This is a model of the destabilizing effect of CBDC

- ▶ destabilizing means making banks more susceptible to panics
- ▶ different from disintermediation of the banking system
  - ▶ role of banks intermediating funds between savers and investors
  - ▶ implying funding real investment otherwise (too) costly to fund
  - ▶ disintermediation is a concern about investors' access to funds
- ▶ panics cause no disruption on the real side of the economy

This is a model of the disruption of financial intermediation *during* a panic not of the severity of its consequences on the recovery

## Conclusion

- ▶ Very nice and thorough paper studying the effect of designing CBDC as a *better cash* on
  - ▶ the effectiveness of certain crisis interventions
  - ▶ the incidence of banking panics
- ▶ What is the optimal policy? Banks' bailout?
- ▶ What is the crowding out effect on private arrangements, which can reduce the incidence of panics?
- ▶ Model of financial disruption *during* a panic