# Central Bank Digital Currency and Monetary Policy

Mohammad Davoodalhosseini

Bank of Canada

Presentation at the *Bank of England Chief Economists' Workshop*

July 13, 2021

Disclaimer: The views expressed in this paper are solely those of the author and no responsibility for them should be attributed to the Bank of Canada.

# Introduction

- Large interest in possibility of introducing CBDC
- Even if CBDC is introduced, cash is expected to be around:
  - *"Some economists advocate that the central bank should replace cash with a digital currency that can be given a negative interest rate. ... I would once again like to say that the Riksbank has a statutory requirement to issue banknotes and coins. I see e-krona primarily as a complement to cash."*

    Cecilia Skingsley, Deputy Governor of the **Riksbank**, 2016
  - "*In its role as the provider of Canadian bank notes, the Bank is working to ensure the processing and distribution of these notes is as efficient as possible. This will help make certain that cash remains a viable method of payment well into the future, ...*"

    Contingency Planing for a CBDC, **Bank of Canada**, 2019

# What I Do

I study optimal monetary policy in the presence of cash and CBDC (money issued by CB in digital format for retail transactions):

- CBDC:
  - Allows transfers contingent on balances
  - Fixed cost of carrying for agents: e.g., cost of losing anonymity
- Cash:
  - Contingent transfers NOT allowed
  - Zero cost

# Policy Messages

- CBDC provides **valuable information** such as agents' CBDC balances or CBDC flows
- CBDC enables governments/CBs to make potentially **non-linear balance-contingent** transfers
  - The **objective** here is to implement optimal MP but could be different, e.g., faster implementation of fiscal policy
  - Can be used for **cross-subsidization**
- Co-existence of cash and CBDC is often sub-optimal, because cash serves as an **outside option** for agents, limiting the MP benefits that CBDC could generate
- **Quantitatively**, if CBDC is about 0.25% more costly than cash, CBDC could lead to 0.12% increase in consumption for the US

# Model Preview

- Two means of payments, cash and CBDC, used for consumption
  - CBDC holdings are observable while cash holdings are not
    - CBDC transfers: $t_e(z_e, w) \in \mathbb{R}_+$
    - Cash transfers: $t_c \in \mathbb{R}_+$
  - Cost of using CBDC is $K \geq 0$; for cash, it's 0

- Focusing on steady state equilibrium, the planner maximizes welfare by choosing: $\{\gamma_c, \gamma_e, t_c, \{t_e(z, w)\}\}$

# Benchmark: Costless CBDC

- Efficiency requires the opportunity cost of holding money to be zero
  - Impossible with cash: because taxing cash holdings or communication with the planner is not possible
  - Possible with CBDC: the optimal scheme requires paying transfers only to agents who bring enough balances (for them to consume the first best)

- CBDC is useful for **cross-subsidization**, e.g., when low-value buyers don't achieve the first best but high-value buyers do

# Costly CBDC

Suppose there are only two types, $w_L$ w. p. $1-\pi$ and $w_H$ w. p. $\pi$.

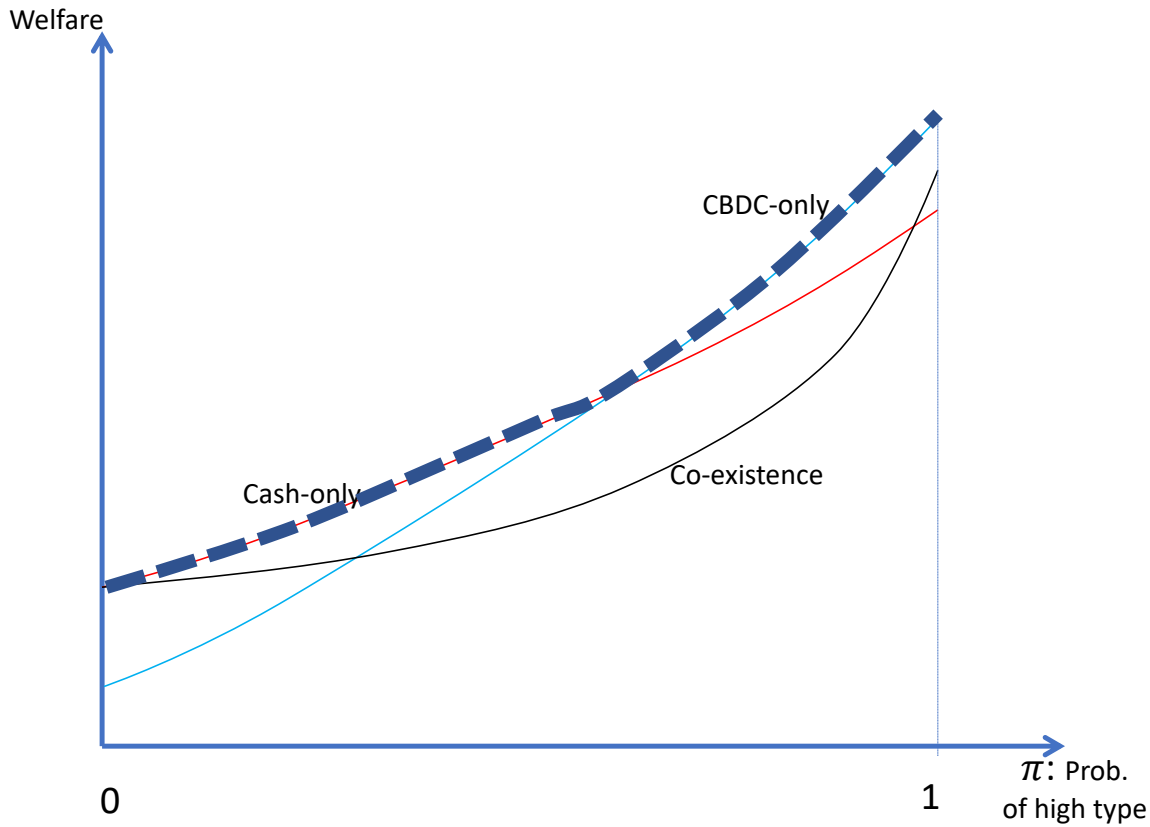
- **Cash-only**: $0$ inflation, welfare loss due to opp. cost of holding cash
- **CBDC-only**: Less distortion, but direct cost $K$
- **Co-existence**:
  - Low cash inflation: cash would be a good alternative for high-value users, prompting them to use cash instead
  - High cash inflation: cash users are hurt

Hence, availability of cash poses a limit on the gains that can be achieved by CBDC

## Proposition

*Under certain parameter restrictions, the **co-existence scheme is NOT optimal**.*

# Costly CBDC


Welfare
CBDC-only
Cash-only
Co-existence
0
1
$\pi$: Prob. of high type

# Welfare Gains of CBDC

| CBDC cost as a fraction of average transaction value (%) | Who uses CBDC? | Welfare gains of CBDC (%) | Welfare gains of CBDC (%) with 20% adoption |
|---|---|---|---|
| **0.000** | both | **0.250** | 0.036 |
| **0.278** | both | **0.121** | 0.005 |
| **0.841** | none | **-0.008** | -0.012 |

Table:

The gains are calculated relative to an economy with only cash under 0% inflation.

Low adoption: 80% of agents use only cash regardless.

# Optimal Scheme

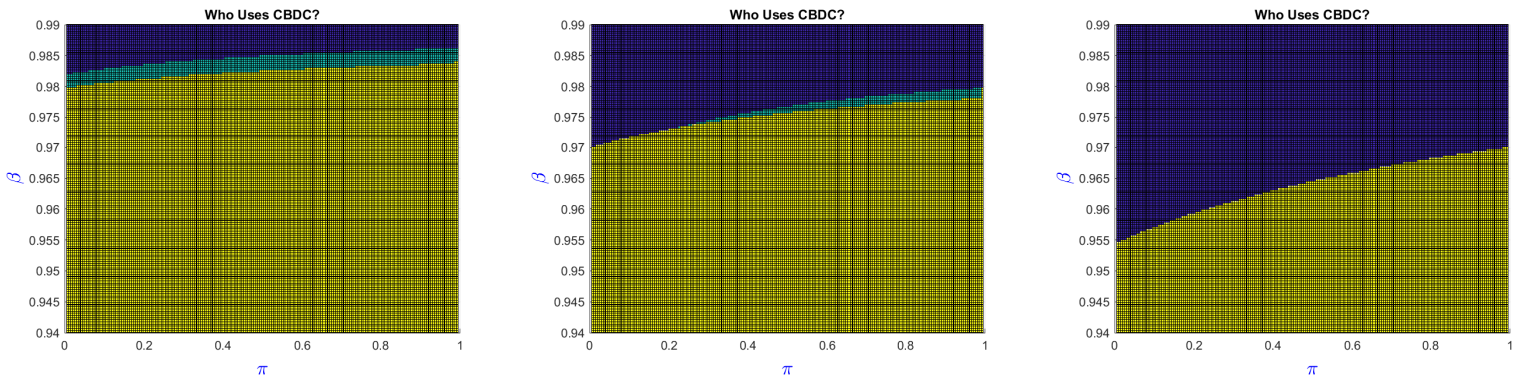



Figure: $K = 0.002$ (left), $K = 0.004$ (middle) and $K = 0.008$ (right).

Yellow: CBDC-only; Green: Co-existence; Blue: Cash-only.

# Insights from Calibration

- Co-existence is often sub-optimal
- As $\pi$ increases, CBDC more likely to be used
- As $\beta$ increases, cash is more likely to be used, because cash is less costly
- As CBDC cost increases, **co-existence** is less likely to be optimal
  - Higher $K \Rightarrow$ lower welfare under CBDC-only and co-existence schemes, but the effect of a tighter IC constraint is dominant
- Insights robust across alternative calibration parameters

# Concluding Remarks

- CBDC is more powerful for MP implementation: e.g., non-linear interest payments
- Co-existence is often sub-optimal even though the first best requires co-existence
- Cash-only and co-existence schemes are more likely to be optimal when agents have privacy concerns compared with the case they don't