# Buffer-stock with continuous choices for consumption and debt

Andreas Laursen, Carl Buan and Peter Ravn

May 2023

# Motivation

**Research question:** Can the buffer-stock model be used to explain the credit card debt puzzle?

**The credit card debt puzzle:** When some households take on high-interest credit card debt, while still holding low-interest liquid assets.

**Possible explanation:** Some low-income households can become credit constrained in any period $\implies$ they borrow as a precaution.

**Our goal:** Model this using the buffer-stock model as in *Precautionary Borrowings and The Credit Card Debt Puzzle*, J. Druedahl and C. Jørgensen, 2015

# Model overview

State variables: $\mathbf{S}_t = (D_{t-1}, A_{t-1}, P_t, Y_t, u_t)$

$$V(\mathbf{S}_t) = \max_{D_t, C_t} \quad \frac{C_t^{1-\rho}}{1-\rho} + \beta \cdot \mathbb{E}_t\left[V(\mathbf{S}_{t+1})\right] \qquad \text{s.t.}$$

$$N_t = A_t - D_t$$

$$D_t \leq \max\left\{(1-\lambda)\cdot D_{t-1},\ \ 1_{u_t=0}\cdot(\eta\cdot N_t + \varphi\cdot P_t)\right\}$$

$$A_t = (1+r_a)\cdot A_{t-1} + Y_t - C_t - \underbrace{r_d \cdot D_{t-1}}_{\text{Interest}} - \underbrace{\lambda\cdot D_{t-1}}_{\text{Installment}} + \underbrace{(D_t - (1-\lambda)\cdot D_{t-1})}_{\text{New debt}}$$

**Key points:**

- A classic buffer-stock model
- Two choice variables: Consumption $C_t$ and debt $D_t$
- The allowed amount of debt depends on unemployment status

  i.e. unemployed $u_t = 1 \implies$ no access to new credit, and vice versa

# Model overview

**Income shocks:**

$$Y_{t+1} = \tilde{\xi}(u_{t+1}, \xi_{t+1}) \cdot P_{t+1}$$

$$P_{t+1} = \Gamma \cdot \psi_{t+1} \cdot P_t$$

$$\tilde{\xi}(u_{t+1}) \equiv \begin{cases} \mu & \text{if} \quad u_{t+1} = 1 \\ \frac{\xi_{t+1} - u_* \cdot \mu}{1 - u_*} & \text{if} \quad u_{t+1} = 0 \end{cases}$$

with $\xi_{t+1}$ and $\psi_{t+1}$ log-normal.

**Unemployment indicator:**

$$u_{t+1} = \begin{cases} 1 & \text{with probability } u^* \text{ (the unemployment rate)} \\ 0 & \text{else} \end{cases}$$

# Plan of action

**Starting point:**

- Solve the model using VFI
- Simplifying assumption: $\eta = 0$ to avoid non-convexities
- Simplifying assumption: Credit-constrained once unemployed i.e. $u_t = 1 \iff$ no borrowing

**Extensions:**

- Solve by NVFI and NEGM and compare performance of solution methods (inspired by Druedahl 2020)
- Discuss implications of non-convexities
- More complex modelling of the credit-constraint $\implies$ whether or not one is credit-constrained does not *only* depend on $u_t$