Credit Crises, Precautionary Savings and the Liquidity Trap

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Household Debt to Disposable Income
Questions

What are the effects of a credit crunch on consumption/saving decisions?

What effects on equilibrium interest rate, on output?

What is the role of precautionary behavior?

Focus on transitional dynamics: transition from high to low household debt to income ratio
Results

After credit crunch:

- households want to accumulate bonds/reduce debt: cut consumption, work more
- effects stronger in the short run
- interest rate falls (more in short than long run)
- output falls (misallocation effect), but hours can go either way
- with nominal rigidities, if interest rate fails to adjust, bigger drop in output
- richer model with durable consumption: output drop concentrated in durables
Some Literature


- connection between credit constraints and liquidity trap: Curdia and Woodford (2009), Eggertsson and Krugman (2011)


Set up

- Bewley economy with elastic labor supply
- preferences
  \[ E \left[ \sum_{t=0}^{\infty} \beta^t U(c_t, n_t) \right] \]
  \( c_t \) consumption, \( n_t \) labor effort
- linear technology
  \[ y_t = \theta_t n_t \]
- individual productivity \( \theta_t \) follows Markov process (purely idiosyncratic risk)
Set up (continued)

- **budget constraint**

\[ b_t + y_t - \tau_t \geq q_t b_{t+1} + c_t \]

(interest rate \(1 + r_t = 1 / q_t\))

- **borrowing constraint** \( \phi \geq 0 \)

\[ b_{t+1} \geq -\phi \]

- **government budget balance**

\[ \widetilde{B} = q_t \widetilde{B} + \tau_t \]
Main Exercise

- start at steady state with $\phi = \phi'$
- unexpected permanent drop to $\phi = \phi'' < \phi'$
  (gradual reduction to avoid default)
- government keeps constant bond supply $\bar{B}$
- what happens to $r_t$ and $Y_t$?

**NOTE:** no aggregate shocks, just transitional dynamics
Equilibrium Definition

An equilibrium is given by:

- interest rates \( \{r_t\} \) and taxes \( \{\tau_t\} \)
- consumption and labor supply functions \( \{C_t(b, \theta), N_t(b, \theta)\} \)
- bond-holdings/productivity distributions \( \{\Psi_t(b, \theta)\} \)

such that, given \( \Psi_0(b, \theta) \):

(i) \( C_t(b, \theta) \) and \( N_t(b, \theta) \) optimal given \( \{r_t\} \) for \( t = 0, 1, 2, \ldots \)
(ii) \( \Psi_t(b, \theta) \) consistent with policies for \( t = 1, 2, \ldots \)
(iii) \( \tau_t \) satisfies government budget balance
(iv) markets clear: \( \int \int_{b,\theta} bd\Psi_t(b, \theta) = \bar{B} \)
Calibration

- preferences

\[ U(c,n) = \frac{c^{1-\gamma}}{1-\gamma} + \psi \frac{(1-n)^{1-\eta}}{1-\eta} \]

- \( \beta = 0.98 \) to get interest rate \( r = 2.5\% \)

- \( \gamma = 4 \)

- \( \eta \) to get Frisch elasticity 1

- \( \psi \) to get \( E[n] = 0.4 \) (Nekarda and Ramey, 2010)
• persistent component of wage process AR1 to match Floden and Lindé PSID evidence

• unemployment state ($\theta = 0$) to capture transitory income losses (transition probability as in Shimer)

• unemployment benefit 40% of average labor income
Calibration (continued)

- \( \bar{B} \) and \( \phi \) to match flow of funds data:
  1. households liquid assets over GDP in 2006 = 1.6
  2. consumer credit over GDP in 2006 = 0.18
  3. shock: reduction to 0.08

where

- liquid assets = deposits + securities held directly by households

- consumer credit \( \approx \) total liabilities - mortgages
Steady State Policies

- Consumption
- Labor Supply
- Bond Accumulation
- Bond CDF
Interest Rate: Comparing Steady States
Transitional Dynamics

borrowing limit

debt/gdp

interest rate

output
Understanding the Overshooting

Bond Accumulation Policy

Bond Distribution
What Happens to Output?

- output depends both on consumption (demand side) and labor supply

- dynamics depend on concavity/convexity of consumption function and labor supply function

- drag on demand: concave consumption function: lower marginal propensity to consume for consumers below their savings target

- labor supply function decreasing and roughly convex: work more to get out of debt
Consumption and Labor Supply Functions

Consumption Policy

Labor Supply Policy
Hours Response

**Baseline**

**Higher \( \psi \)**
Nominal Rigidities

- output produced by continuum of monopolistically competitive firms $i \in [0, 1]$

- Dixit-Stiglitz preferences

$$c_t = \left( \int_0^1 c_t(i) \frac{\epsilon-1}{\epsilon} di \right)^{\frac{\epsilon}{\epsilon-1}}$$

- each firm produces with linear technology which produces one unit of good per efficiency unit

- $\theta_t$: shock to household labor efficiency
Monopolistic Competition

- monopolist producing good $i$ faces demand

$$y_{i,t} = \left( \frac{p_{i,t}}{P_t} \right)^{-\varepsilon} Y_t$$

- in symmetric equilibrium firms’ profits:

$$\Pi_t = \frac{1}{\varepsilon - 1} W_t Y_t$$

- consumers receive firms’ profits

$$q_t b_{t+1} + P_t c_t = b_t + W_t \theta_t n_t - \tau_t + \Pi_t$$

- dynamics very similar to baseline
Fixed Prices

- large menu costs, firms do not adjust prices at all:
  \[ P_t = P_{t-1} \]
- hence
  \[ P_t \neq \frac{\varepsilon}{\varepsilon - 1} W_t \]
- output determined by demand
- central bank chooses sequence of \( \{r_t\} \) that converges to \( r' \)
Rigid Prices

borrowing limit

[Graph showing the borrowing limit over time with a central bank that tries to replicate flexible prices]

debt/gdp

[Graph showing the debt to GDP ratio over time]

interest rate

[Graph showing the interest rate over time]

output

[Graph showing the output over time]
Fiscal Policy

- what happens if government increases supply of bonds?

- two beneficial effects: (i) directly reduces downward pressure on $r$; (ii) reduces tax in short run

- gradual increase in $B$ of 20%

- **Experiment I**: $\tau_t$ adjusts to balance government budget

- **Experiment II**: unemployment benefit adjusts to balance government budget
Fiscal Policy: Tax Cut

**Interest Rate**
- Tax Cut
- No Intervention

**Output**
- Tax Cut
- No Intervention
Fiscal Policy: Unemployment Benefit

interest rate

unemployment insurance

no intervention

tax cut

output

0 5 10 15 20 25
−1.4 −1.2 −1 −0.8 −0.6 −0.4 −0.2 0

0 5 10 15 20 25
−14 −12 −10 −8 −6 −4 −2 0

tax cut

no intervention

unemployment insurance
Durable Goods

- bigger role for debt than in baseline
- households get into debt when hit by good shocks
- they borrow to buy durables
- however also a new store of value: agents can save in bonds or in durables
- assume durables less liquid than bonds
Model

- cost to accumulate $k_{t+1}$ starting from $k_t$

\[
g (k_{t+1}, k_t) = \begin{cases} 
  k_{t+1} - k_t + \delta k_t & \text{if } k_{t+1} \geq k_t \\
  (1 - \zeta) (k_{t+1} - k_t) + \delta k_t & \text{if } k_{t+1} < k_t
\end{cases}
\]

with $\zeta \in (0, 1)$ liquidation cost

- secured lending: borrowing constraint with collateral

\[b_{t+1} \geq -\phi_k k_{t+1}\]
Model

- spread between borrowing and lending

- budget constraint

\[ q_t b_{t+1}^+ + \hat{q}_t b_{t+1}^- + g(k_{t+1}, k_t) + c_t \leq b_t + y_t - \tau_t \]

\[ spread = \frac{1}{\hat{q}_t} - \frac{1}{q_t} \]

- shock to spread that gives drop in debt to GDP from 60% to 50%
Optimal Portfolio

- \( V(b, k, \theta) \): household’s value function

- optimality condition for durables if \( b' > 0 \)

\[
(1 - \zeta)E[V_b(b', k', \theta')|\theta] \leq qE[V_k(b', k', \theta')|\theta] \leq [V_b(b', k', \theta')|\theta]
\]

with first equality if \( k' < k \) and second equality if \( k' > k \)

- split household problem in two stages:
  1. choose total savings
  2. choose portfolio allocation
Portfolio Choice

- High total savings
- Low total savings
- Initial capital

Diagram showing the relationship between capital (k') and an external factor (b').
Calibration

- preferences:

\[ U(c, n) = \frac{(c^\alpha k^{1-\alpha})^{1-\gamma}}{1-\gamma} + \psi \frac{(1-n)^{1-\eta}}{1-\eta} \]

- \( \gamma = 4, \, \psi, \, \eta, \, \bar{B} \) calibrated as in the benchmark
- \( \alpha = 0.7 \) to match durables/total consumption in NIPA
- \( \delta = .05 \) from NIPA
- \( \phi_k = 0.8, \, \zeta = 0.15 \)
- shock: spread = 1% to 2.22%
Transitional Dynamics

interest rate

total consumption
Transitional Dynamics

non durable consumption

durable consumption
Decomposition

**Non Durable Goods**
- Lenders: Red line
- Borrowers: Green line

**Durable Goods**
- Lenders: Black line
- Borrowers: Green line
Transitional Dynamics: Temporary Shock

- Interest rate
- Total consumption

Graph showing the transitional dynamics of interest rates and total consumption following a temporary shock. The graphs illustrate the behavior of these variables over time, with a sharp initial decrease followed by a gradual recovery and stabilization.
Transitional Dynamics: Temporary Shock

non durable consumption

0 5 10 15 20 25 30
0.99 0.995 1 1.005 1.01

Durable consumption

0 5 10 15 20 25 30
0.8 0.9 1 1.1 1.2
Open Issues

- we modelled the deleveraging, not the way up
- intermediation and endogenous spreads
- default
- more heterogeneity/shocks for borrowing, life-cycle considerations
- capital (with spreads)
- asset prices (durable prices)