

The Liquidity Trap and Leverage

14.454

Ricardo Caballero

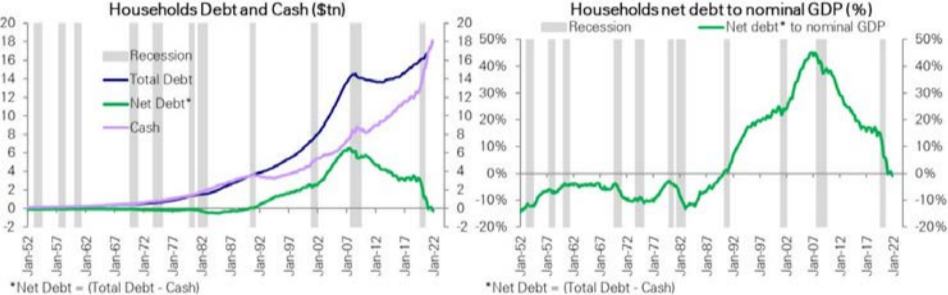
MIT

Economic Crises

- ▶ You are familiar with the liquidity trap from 14.453
- ▶ Our focus: Role of *leverage* and *deleveraging*.
- ▶ Overborrowing due to an *AD externality* (instead of a pecuniary externality)

- ▶ (*) A. Korinek and A. Simsek, “Liquidity Trap and Excessive Leverage,” *American Economic Review*, 106(3), 699–738, 2016

Figure 1: US Household cash exceeds debt for the first time in three decades....



Source : FRB, BEA, Haver, Deutsche Bank

Introduction

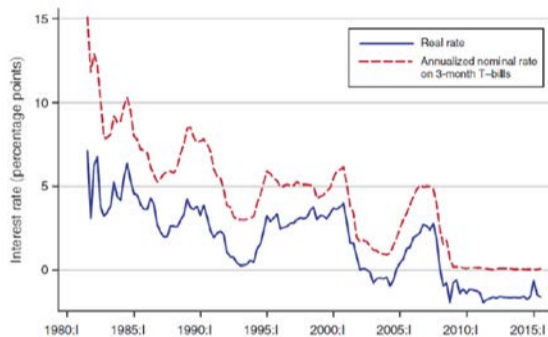


FIGURE 2. NOMINAL AND REAL INTEREST RATES IN THE UNITED STATES

Notes: Nominal and real interest rates on three-month US Treasury Bills in annualized percentage points. The real interest rate is calculated as the nominal rate minus the expected GDP deflator.

Source: Federal Reserve Bank of Philadelphia *Survey of Professional Forecasters*, series TBILL2 and RR1_TBILL_PGDP_2.

Main results of K-S: Excessive leverage and underinsurance

Model with **anticipated deleveraging and liquidity trap.**

- ▶ Contributing factors:
Impatience, previous leverage, optimism...

Main results:

- ▶ Competitive equilibrium is **constrained inefficient.**
- ▶ **Excessive leverage** and **underinsurance.**
- ▶ Pareto improvement by **macroprudential policies** targeted towards reducing leverage, e.g., **debt limits** and **mandatory insurance.**

Key channel: Aggregate demand externality

Source of inefficiency: **Aggregate demand externality.**

Greater ex-ante leverage:

⇒ Lower ex-post wealth for borrowers, higher for lenders.

⇒ **Lower aggregate demand.**

(Since borrowers have higher MPC due to deleveraging).

⇒ Deeper recession and lower output.

Similar mechanism for underinsurance.

Environment with anticipated borrowing constraints

- ▶ Single good (dollar) and dates $t \in \{0, 1, \dots\}$
- ▶ Households $h \in \{b, l\}$, with equal mass normalized to 1/2
- ▶ Types identical except $\beta^b \leq \beta^l$ and $d_0 \equiv d_0^b = -d_0^l \geq 0$

First ingredient: Future borrowing constraints:

- ▶ For each $t \geq 1$, agents face borrowing constraint $d_{t+1}^h \leq \phi$.
- ▶ In contrast, at $t = 0$, they can choose d_1 without constraint

- ▶ Tightening is **anticipated**. No uncertainty in baseline
- ▶ Let r_{t+1} denote the real interest rate between t and $t + 1$.

Main ingredient: Lower bound on the interest rate

- ▶ Key ingredient is **the lower bound on the real interest rate**:

$$r_{t+1} \geq \underline{r} \quad \text{for each } t \geq 1.$$

- ▶ In practice, the lower bound emerges from two features:

- 1 **Zero lower bound on the nominal interest rate:**

$$i_{t+1} \geq 0 \quad \text{for each } t \geq 0.$$

- 2 **Sticky inflation expectations:**

$$E_t [P_{t+1}/P_t] = 1 + \zeta \quad \text{for each } t \geq 1.$$

The combination gives the bound on the real rate with $\underline{r} \simeq -\zeta$. We will assume fully sticky prices, so $\underline{r} = 0$

- ▶ Baseline preferences (remove income effect from labor supply): $u(\tilde{c}_t^h - v(n_t^h))$
- ▶ Define $c_t^h = \tilde{c}_t^h - v(n_t^h)$ as net consumption. Households solve:

$$\max_{\{c_t^h, d_{t+1}^h, n_t^h\}_t} \sum_{t=0}^{\infty} (\beta^h)^t u(c_t^h)$$

$$\text{s.t. } c_t^h = e_t^h - d_t^h + \frac{d_{t+1}^h}{1+r_{t+1}} \text{ for all } t,$$

where $e_t^h = w_t n_t^h + \Pi_t - v(n_t^h)$ denotes net income,

and $d_{t+1}^h \leq \phi$ for each $t \geq 1$.

- ▶ Technology: 1 unit of labor to 1 unit of consumption good

- ▶ Efficient level of output maximizes net income:

$$e^* = \max_{n_t} n_t - v(n_t).$$

- ▶ Equilibrium does not necessarily feature e^* due to bound on r_{t+1}

- ▶ (Symmetric) Monopolists meet all of the demand in equilibrium (since $MC < \text{price}$)
- ▶ So outcomes are determined by demand

$$e_t = \frac{c_t^b + c_t^l}{2}$$

- ▶ This depends on monetary policy...

Lemma

If $r_{t+1} > 0$, $e_t = e^$. If $r_{t+1} = 0$,
 $e_t = \frac{c_t^b + c_t^l}{2} < e^*$*

- ▶ If $r_{t+1} = 0$, price of current consumption too high. Demand too low.

Equilibrium after deleveraging is complete

- ▶ Dates $t \geq 2$: Steady state with $1 + r_{t+1} = 1/\beta^l > 1$
- ▶ This implies rationing constraint does not bind: $e_t = e^*$
- ▶ Agents' consumption is given by:

$$c_2^l = e^* + \phi(1 - \beta^l) \quad \text{and} \quad c_2^b = e^* - \phi(1 - \beta^l).$$

- ▶ Next consider date 1, the date at which deleveraging happens...

Borrowers' (constrained)
consumption:

$$c_1^b = e_1 - \left(d_1 - \frac{\phi}{1+r_2} \right).$$

Lenders' (unconstrained)
consumption:

$$c_1^l = e_1 + \left(d_1 - \frac{\phi}{1+r_2} \right).$$

- ▶ Increase mediated by reduction in real rates (Euler):

$$u'(c_1^l) = \beta^l (1+r_2) u'(e^* + \phi(1-\beta^l)).$$

- ▶ Constraint $r_2 \geq 0$, implies **upper bound on lender's consumption**:

$$c_1^l \leq \bar{c}_1^l \text{ where } u'(\bar{c}_1^l) = \beta^l u'(e^* + \phi(1-\beta^l)).$$

Equilibrium during the deleveraging episode

Equilibrium depends on:

$$\underbrace{d_1 - \phi}_{\text{leverage adjustment at 0 rate}} \leq \underbrace{\bar{c}_1^l - e^*}_{\text{unconstrained agents' buffer at 0 rate}},$$

- ▶ If adjustment is sufficiently small, then $r_2 > 0$ and $e_1 = e^*$.
- ▶ Otherwise, if leverage is sufficiently high:

$$d_1 \geq \bar{d}_1 = \phi + \bar{c}_1^l - e^*,$$

then $r_2 = 0$ and we are in the constrained regime...

- ▶ Net income is then determined by aggregate demand:

$$e_1 = \frac{c_1^b + c_1^l}{2}$$

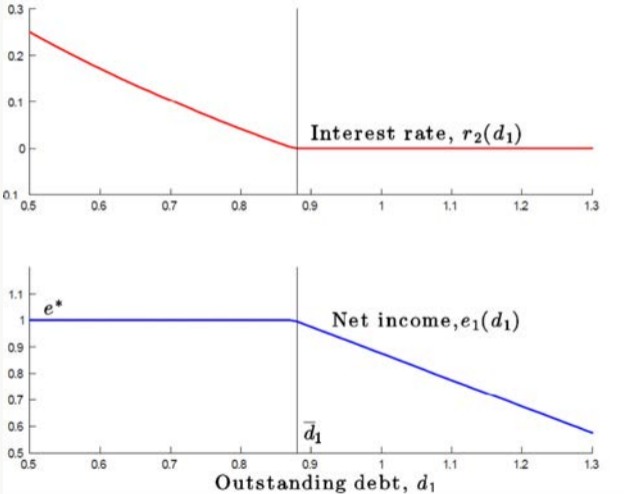
- ▶ Agents' consumption are $c_1^b = e_1 - (d_1 - \phi)$ and $c_1^l = \bar{c}_1^l$, and thus:

$$e_1 = \frac{e_1 - (d_1 - \phi) + \bar{c}_1^l}{2}.$$

- ▶ This is a Keynesian cross with associated Keynesian multiplier.
- ▶ Solving it, we obtain the equilibrium net income:

$$e_1 = c_1^l + \phi - d_1.$$

Pictorial illustration of equilibrium



- ▶ Date 0 equilibrium determined by Euler equations:

$$1 + r_1 = \frac{u'(c_0^l)}{\beta^l u'(c_1^l)} = \frac{u'(c_0^b)}{\beta^b u'(c_1^b)}.$$

Proposition

There is a recession at date 1, $d_1 > \bar{d}_1$, as long as:

- (i) Borrowers are sufficiently impatient: $\beta^b < \bar{\beta}^b(d_0)$ or*
- (ii) Borrowers are sufficiently indebted: $d_0 > \bar{d}_0(\beta^b)$.*

- ▶ Recession is anticipated. Is it efficient? We turn to welfare analysis...

- ▶ Define agents' date 1 welfare as a function of debt:

$$V^b \left(\underbrace{d_1}_{\text{own}}, \underbrace{D_1}_{\text{aggregate}} \right) = u \left(e_1(D_1) - d_1 + \frac{\phi}{1 + r_2(D_1)} \right) + \text{continuation}.$$

- ▶ If $D_1 < \bar{d}_1$, then usual pecuniary externalities apply:

$$\frac{\partial V^h}{\partial D_1} = \begin{cases} -\eta u'(c_1^h) < 0, & \text{if } h = l \\ \eta u'(c_1^h) > 0, & \text{if } h = b \end{cases}, \text{ where } \eta \in (0, 1).$$

- ▶ Externalities net out. Equilibrium is constrained efficient in this range.

- ▶ If $D_1 > \bar{d}_1$, then **aggregate demand externalities** apply:

$$\frac{\partial V^h}{\partial D_1} = \frac{\partial e_1}{\partial D_1} u'(c_1^h) = -u'(c_1^h) < 0, \text{ for each } h \in \{b, l\}.$$

- ▶ Unlike price externalities, **AD externalities negative for all agents.**

- ▶ Opens the door for inefficiencies....

Main result: Ex-ante inefficiency and excessive leverage

- ▶ Suppose planner can impose **endogenous debt limit**: $d_1^h \leq D_1$.
- ▶ Can also use date 0 transfer, T_0 , to trace the Pareto frontier.
- ▶ Constrained efficient: Can be implemented with these policies.

Proposition

An allocation is constrained efficient iff $e_0 = e^*$ and:

- (i) $D_1 < \bar{d}_1$ and the usual Euler equations hold.
- (ii) $D_1 = \bar{d}_1$ the following **distorted Euler inequality** holds:

$$\frac{\beta^l u'(c_1^l)}{u'(c_0^l)} > \frac{\beta^b u'(c_1^b)}{u'(c_0^b)} .$$

- ▶ Implication: Equilibrium with $d_1 > \bar{d}_1$ is **constrained inefficient**.
- ▶ Intuition for policy: First order gains from AD externalities but only second order losses from distorting agents' Euler equations.

- ▶ In fact, in this model the externality is so strong, that even ex-post debt forgiveness to bring debt to \bar{d}_1 is Pareto (the negative wealth effect for the lender is offset by the positive AD effect)
- ▶ Note: Again, the pecuniary externality alone is not enough to justify policy intervention.

- ▶ Consider a version with two states $s \in \{H, L\}$ at date 1
 - State H , there is no debt limit $\phi = \infty$
 - State L , as before (low leverage)
- ▶ Markets are complete: at date 0, choose debt and A-D insurance
- ▶ Full insurance condition:

$$q_{1L} = \frac{\pi_L^l \beta^l u'(c_{1L}^l)}{u'(c_0^l)} = \frac{\pi_L^b \beta^b u'(c_{1L}^b)}{u'(c_0^b)}$$

- ▶ Social planner would want (minimum insurance):

$$\frac{\pi_L^l \beta^l u'(c_{1L}^l)}{u'(c_0^l)} > \frac{\pi_L^b \beta^b u'(c_{1L}^b)}{u'(c_0^b)}$$

MIT OpenCourseWare
<https://ocw.mit.edu/>

14.454 Economic Crises
Spring 2026

For information about citing these materials or our Terms of Use, visit: <https://ocw.mit.edu/terms>.