Liquidity Trap and Excessive Leverage

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Deleveraging and the recession might be related

Micro evidence: Deleveraging explains much of job losses (Mian-Sufi).
One view: Low rates and the liquidity trap

- Formalized by: Eggertsson-Krugman, Hall, Guerrieri-Lorenzoni...
- Stimulated policy analysis. Ex-post focus. Ignored debt market.

This paper: Ex-ante/macroprudential policies.
Main results: 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.
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.
Interest rate policy is not the ideal tool to reduce leverage

Results on the use of monetary policy:

- Common argument: Raising $r$ can curb leverage.
- Under normal circumstances: higher $r$ may actually raise leverage! → conventional wisdom dominated by general equilibrium effects.
- Even when conventional wisdom dominates, raising $r$ is inefficient.
- Problem is misallocation of wealth between borrowers-lenders.
- Macroprudential policies target this. Interest rate policy does not.

Korinek and Simsek (2015)
Deleveraging and the liquidity trap: Eggertsson-Krugman...

- We focus on debt market policies and ex-ante policies.

Aggregate demand externalities:

- More recent work by Schmitt-Grohe-Uribe and Farhi-Werning.
- We focus on an application to a liquidity trap

Excessive leverage: Optimism, moral hazard, fire-sale externalities.

- New mechanism. Complementary, but important differences.
Environment with anticipated borrowing constraints

- Single good (dollar) and dates $t \in \{0, 1, ..\}$.
- 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 $d_{t+1}^h \leq \phi$, which is fully **anticipated** in baseline setup.
  - At $t = 0$, they can choose $d_1$ without constraint.
- Let $r_{t+1}$ denote the real interest rate between $t$ and $t + 1$. 
Key ingredient is the lower bound on the real interest rate:

\[ r_{t+1} \geq 0 \text{ for each } t \geq 1. \]

In practice, the lower bound emerges from two features:

1. Zero lower bound on the nominal interest rate, \( i_{t+1} \geq 0 \).
2. Sticky nominal prices.

We remain agnostic with respect to the source of stickiness.
Demand side: Household optimization

- Baseline preferences $u(\tilde{c}_t^h - v(n_t^h))$. (Appendix: $u(c) - v(n)$).
- Define $c_t^h = \tilde{c}_t^h - v(n_t^h)$ as net consumption. Households solve:

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

s.t. $c_t^h = e_t^h - d_t^h + \frac{d_{t+1}^h}{1 + r_{t+1}}$ 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 $t \geq 1$. 

Korinek and Simsek (2015)
Supply side: Linear technology

- 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 \( r_{t+1} \).
- We modify the Walrasian supply side to accommodate the bound...
Supply side: Rationing when interest rate is too high

- Final good firms solve:

\[
\Pi_t = \max_{n_t} n_t - w_t n_t \quad \text{s.t.} \quad \begin{cases} 
0 \leq n_t, & \text{if } r_{t+1} > 0 \\
0 \leq n_t \leq \frac{\bar{c}_t + \bar{c}_t}{2}, & \text{if } r_{t+1} = 0.
\end{cases}
\]

- If \( r_{t+1} > 0 \), firms optimize as usual.
- If \( r_{t+1} = 0 \), firms are subject to additional \textbf{rationing constraint}.

Equilibrium is \( \{ \tilde{c}_t^h, n_t^h, c_t^h, e_t^h, d_{t+1}^h \} \) \( h, t \), \( \{ w_t, r_{t+1}, \Pi_t \} \) \( t \) such that...

- Rationing equilibrium. Isomorphic to NK model with fully sticky prices.
Equilibrium after deleveraging is complete

- Dates $t \geq 2$: Steady state with $1 + r_{t+1} = 1/\beta^l > 0$.
- This implies rationing constraint does not bind: $e_t = e^*$.
- Agents’ consumption is given by:
  
  \[ c_2^l = e^* + \phi \left( 1 - \beta^l \right) \text{ and } c_2^b = e^* - \phi \left( 1 - \beta^l \right). \]

- Next consider date 1, the date at which deleveraging happens...
Equilibrium during the deleveraging episode

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):

\[ u' \left( c_1^l \right) = \beta^l \left( 1 + r_2 \right) u' \left( e^* + \phi \left( 1 - \beta^l \right) \right) . \]

- Constraint \( r_2 \geq 0 \), implies **upper bound on lender consumption**:

\[ c_1^l \leq \bar{c}_1^l \text{ where } u' \left( \bar{c}_1^l \right) = \beta^l u' \left( e^* + \phi \left( 1 - \beta^l \right) \right) . \]
Equilibrium during the deleveraging episode

Equilibrium depends on:

\[ d_1 - \phi \geq \bar{c}_1 - e^* \]

leverage adjustment at 0 rate

unconstrained agents’ buffer at 0 rate

- If adjustment is sufficiently small, then \( r_2 > 0 \) and \( e_1 = e^* \).
- Otherwise, equivalently, if leverage is sufficiently high

\[ d_1 \geq \bar{d}_1 = \phi + \bar{c}_1 - e^* \]

then \( r_2 = 0 \) and we are in the constrained/rationing regime...

Korinek and Simsek (2015)
Net income is then determined by aggregate demand:

\[ e_1 = \frac{c_1^b + c_1^l}{2} = \frac{e_1 - (d_1 - \phi) + \bar{c}_1^l}{2}. \]

This is a Keynesian cross with associated Keynesian multiplier.

Solving it, we obtain the equilibrium net income:

\[ e_1 = \bar{c}_1^l + \phi - d_1. \]
Graphical illustration of equilibrium

Korinek and Simsek (2015)
Conditions for an anticipated recession

- 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, \( d_1 > \bar{d}_1 \), if:

- (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:

\[
V^b \left( \begin{array}{c}
d_1 \\
\text{own}
\end{array}, \begin{array}{c}
D_1 \\
\text{aggregate}
\end{array} \right) = u \left( e_1 (D_1) - d_1 + \frac{\phi}{1 + r_2 (D_1)} \right) + \text{continuation}.
\]

If \( D_1 < \bar{d}_1 \), then \( r > 0 \) and usual pecuniary externalities apply:

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

Externalities net out. Equilibrium is constrained efficient in this range.
Aggregate demand externalities hurt all agents

- If $D_1 > d_1$, then $e < e^*$ and **aggregate demand externalities** apply:

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

- 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:

\[
\frac{\beta^l u'(c_1^l)}{u'(c_0^l)} \geq \frac{\beta^b u'(c_1^b)}{u'(c_0^b)}.
\]

Korinek and Simsek (2015)
Main result: Ex-ante inefficiency and excessive leverage

- Implication: Equilibrium with $d_1 > \tilde{d}_1$ is **constrained inefficient**.
- Intuition: First order gains vs. second order losses.
- The result is general—except the part that recession is fully avoided...
Inefficiency is related to MPC differences

- Version with lower MPCs for borrowers implies weaker externalities:

\[
\frac{\partial e_1}{\partial d_1} = -\frac{MPC_b - MPC_l}{2 - (MPC_b + MPC_l)}.
\]

- Debt matters because it **redistributes** ex-post wealth from \( b \) to \( l \).
- Evidence, e.g., Mian-Rao-Sufi (2013), suggests \( MPC_b > MPC_l \).
Required intervention is related to MPC differences

• Constrained efficient allocations in this case satisfy:

\[
\frac{1}{1 - \text{MPC}_1^l} \frac{\beta^l u'(c_1^l)}{u'(c_0^l)} = \frac{1}{1 - \text{MPC}_1^b} \frac{\beta^b E_0 [u'(c_1^b)]}{u'(c_0^b)} \quad \text{for each } D_1 > \bar{d}_1.
\]

• Planner weighs agents’ consumption at date 1 by a factor \( \frac{1}{1 - \text{MPC}_1^h} \).

• Do not fully alleviate the recession.

• Instead create \textit{wedge between borrowers’ and lenders’ rates}.

• The magnitude of optimal wedge depends on MPC differences.
Extension with underinsurance

- Version with aggregate uncertainty, captured by states $s \in \{H, L\}$.
- Equilibrium determined by Euler and **full-insurance**:
  
  $$\frac{q_{1,L}}{q_{1,H}} = \frac{\pi^l_L}{\pi^l_H} \frac{u'(c^l_{1,L})}{u'(c^l_{1,H})} = \frac{\pi^b_L}{\pi^b_H} \frac{u'(c^b_{1,L})}{u'(c^b_{1,H})}.$$ 

- Constrained efficient: $D_{1,L} = \bar{d}_1$ and **distorted insurance**:
  
  $$\frac{\pi^l_L}{\pi^l_H} \frac{u'(c^l_{1,L})}{u'(c^l_{1,H})} \geq \frac{\pi^b_L}{\pi^b_H} \frac{u'(c^b_{1,L})}{u'(c^b_{1,H})}.$$ 

- Result: Pareto improvement with **mandatory insurance**.
The case for mandatory home equity insurance

- Distinct policy prescription: Index debt to financial shocks.
- Home equity insurance was long proposed by Shiller and Weiss (1999).
- In practice, households do not seem interested (due to optimism?).
- Our model: **Make it mandatory**, especially for large price declines.
Preventive monetary policies

Are preventive monetary policies desirable?

- Raising the inflation target: Yes (Blanchard et al., 2010).
- How about raising the interest rate at date 0?
- We can capture with date 0 constraint $r_1 \geq r_1$.

Proposition

Suppose $u$ is in the CRRA family and $d_0 > \frac{d_1(r_1)}{1+r_1}$. Then:

\[ e_0'(r_1) < 0 \text{ and } d_1'(r_1) > 0. \]

- Increasing the interest rate can increase leverage!
Raising the ex-ante interest rate can backfire

Consider special case with \( u(c) = \log c \) and \( \phi = 0 \):

\[
\begin{align*}
d_1^b &= \frac{1}{1 + \beta^b} \left( e_1 - \beta^b (1 + r_1) (e_0 - d_0) \right) \\
d_1^l &= \frac{1}{1 + \beta^l} \left( e_1 - \beta^l (1 + r_1) (e_0 + d_0) \right).
\end{align*}
\]

Closed form solution illustrates three forces:

1. **Substitution effect**: higher \( r_1 \) reduces \( d_1^b \), but increases \( d_1^l \) → substitution effect leads to conflicting results

2. **Recession/income effect**: as \( e_0 \) falls, \( d_1^b \) increases, \( d_1^l \) falls → this offsets the substitution effects

3. **Redistribution**: higher \( r_1 \) transfers wealth from \( b \) to \( l \), raising \( d_1^b \) → under natural assumptions, effect 3 prevails

Korinek and Simsek (2015)
Interest rate policy is not the right tool for the problem

- Can construct variants under which conventional wisdom dominates, for example if interest rates tighten financial constraints
- But even then, **interest rate policy is inefficient.**
  1. Inefficient recession at date 0.
  2. Usual Euler equation holds as opposed to distorted Euler inequality.
- Intuitively, MP targets **the wrong wedge** (between date 0 and 1).
- Macropudential policies target the right wedge (between $b$ and $l$).

Korinek and Simsek (2015)
Conclusion: Liquidity trap and excessive leverage

Model with anticipated liquidity trap:

- Excessive leverage and underinsurance.
- Source: Aggregate demand externalities.

New rationale for macroprudential policies that regulate leverage.