Economics 704a Bonus Lecture 1 : Liquidity Trap and Unconventional Policy II

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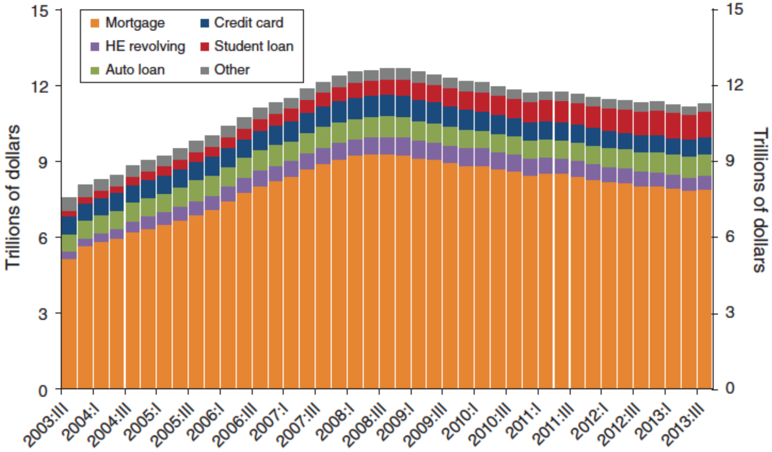
Outline: The Liquidity Trap

1. What Is the Effect of a Liquidity Trap in the NK Model?
2. What Is Optimal Monetary Policy in a Liquidity Trap?
   2.1 Forward Guidance (Gali 5.4)
   2.2 Other Unconventional Policies
   2.3 Is Zero the Lower Bound?
3. What Is the Role of Fiscal Policy in a Liquidity Trap?
4. How Does an Economy Get Into a Liquidity Trap? (Eggertsson-Krugman)
   4.1 Debt and Deleveraging
   4.2 Fisherian Debt-Deflation Spiral and the Paradoxes
5. Does a Liquidity Trap Create a Role For Macroprudential Policy? (Korinek-Simsek)

- Today, switch to completely different model to consider different issues (4 and 5).

How Does an Economy Get Into a Liquidity Trap?

- Recent lit: *Balance sheet effects* from deleveraging of debt.



Eggertsson-Krugman Endowment Economy: Setup

- Unit mass of two types of households $h = \{b, l\}$, each of whom make up half of population and get half of endowment Y:
  - Patient Lenders ($h = l$): Discount factor $\beta^l = \beta$.
  - Impatient Borrowers ($h = b$): Discount factor $\beta^b < \beta$.
- Preferences:

$$E_t \left\{ \sum_{s=0}^{\infty} \left(\beta^h\right)^s \log C_{t+s}^h \right\}$$

- Budget constraint for both agents:

$$D_t^h = (1 + r_{t-1})\, D_{t-1}^h - \frac{1}{2} Y + C_t^h$$

- Exogenous debt constraint:

$$(1 + r_t)\, D_t^h \leq \bar{D} > 0$$

  - $\bar{D}$ assumed below natural borrowing limit (PDV of Y).

Eggertsson-Krugman Endowment Economy: Equilibrium

- Impatient agent borrows up to limit, patient is on Euler:

$$C_t^b = \frac{1}{2}Y - \frac{r_t}{1+r_t}\bar{D}$$
$$\frac{1}{C_t^l} = (1+r_t)\,\beta E_t\left\{\frac{1}{C_{t+1}^l}\right\}$$

- Aggregate resource constraint $Y = C_t^l + C_t^b$ implies

$$C_t^l = \frac{1}{2}Y + \frac{r_t}{1+r_t}\bar{D}$$

- Combining with Euler, in steady state

$$r = \frac{1-\beta}{\beta}$$

  - Discount rate of lender pins down interest rate.
  - Given interest rate, borrower is on debt constraint.

E-K Endowment Economy: Deleveraging Shock

- Assume that $\bar{D}$ falls to $\underline{D}$ and that borrowers must immediately satisfy new debt limit.
  - "Wile E. Coyote moment" or "Minsky moment."[1]
- Since this occurs in one period, divide into "long run" L and "short run" S.
  - S is the period of the deleveraging shock
  - L is new steady state reached one period after deleveraging shock and replicated forever onward.

[1] Best paper footnote ever: "For those not familiar with the classics, a recurrent event in the Warner Bros. Road Runner cartoons is the point when Wile E. Coyote, having run several steps off a cliff, looks down. According to the laws of cartoon physics, its only when he realizes that nothing is supporting him that he falls."

E-K Endowment Economy: Deleveraging Shock

- In long run,

$$
\begin{aligned}
C_L^b &= \frac{1}{2}Y - \frac{r}{1+r}\underline{D} = \frac{1}{2}Y - (1-\beta)\,\underline{D} \\
C_L^l &= \frac{1}{2}Y + \frac{r}{1+r}\underline{D} = \frac{1}{2}Y + (1-\beta)\,\underline{D}
\end{aligned}
$$

- In short run, borrower must satisfy budget constraint:

$$D_S = \bar{D} - \frac{1}{2}Y + C_S^b$$

and debt constraint $D_S = \frac{\underline{D}}{1+r_S}$ so:

$$C_S^b = \frac{1}{2}Y + \frac{\underline{D}}{1+r_S} - \bar{D}$$

- Combine with resource constraint:

$$C_S^l = \frac{1}{2}Y - \frac{\underline{D}}{1+r_S} + \bar{D}$$

E-K Endowment Economy: Deleveraging Shock

- Lender is on Euler $C_L^l = (1 + r_S)\,\beta C_S^l$ with:

$$C_S^l = \frac{1}{2}Y - \frac{\underline{D}}{1 + r_S} + \bar{D}$$
$$C_L^l = \frac{1}{2}Y + (1 - \beta)\,\underline{D}$$

- The real interest rate is:

$$1 + r_S = \frac{\frac{1}{2}Y + \underline{D}}{\beta\frac{1}{2}Y + \beta\bar{D}}$$

- This is negative if the deleveraging shock is big enough and:

$$\beta\bar{D} - \underline{D} > \frac{1}{2}(1 - \beta)\,Y$$

- Intuition: Crunch in debt constraint reduces consumption of borrower, and lender must make up slack. Euler implies r falls, may go negative if lender needs to increase consumption a lot.

E-K Endowment Economy: Deflation

- Add in nominal government debt in zero net supply:

$$\frac{1}{P_t C_t^l} = (1 + i_t)\, \beta E_t \left\{ \frac{1}{P_{t+1} C_{t+1}^l} \right\}$$

- Assume price level stable at P^* in steady state so $P_L = P^*$ and

$$1 + r_s = (1 + i_s)\, \frac{P_S}{P^*}$$

- If deleveraging causes $r_S < 0$ and $i_t \geq 0$, then *deflation*:

$$\frac{P_S}{P^*} = 1 + r_s < 1$$

- Intuition: i stuck, so to get negative r need $E_t \{\pi_{t+1}\}$ positive.
    - With price level stable in long run, this implies deflation today so prices can rise tomorrow.
    - Can eliminate deflation by committing to inflation after trap (which lasts one period) by raising P^*.

Notes on the Literature

- In a production economy with sticky prices, instead of just deflation get mix of decline in output and deflation (see PSet).
- Guerrieri and Lorenzoni (2015):
  - Full heterogeneous agents Bewley model, instead of a representative lender and representative borrower.
  - Generates more realism and precautionary savings effects, which provide important results missing from b and l case.
- Midrigan and Philippon (2016):
  - Cash-in-advance constraint approach in quantitative model with debt and nominal rigidity.
  - Estimate model and find decline in debt in Great Recession only pushed real rate down 1.5%.
    - Not enough to cause liquidity trap on its own.
  - Could cause ZLB if natural rate fall for other reasons.
    - E.g., other financial frictions, global savings glut.

E-K Endowment Economy: Fisherian Debt-Deflation Spiral

- Previous model had real debt, but most debt is nominal.
  - Consider nominal debt B_t with *real* debt constraint $\underline{D}$.
- Borrowers start period of deleveraging with real debt of $\bar{D} = \bar{B}/P_S$ and must reduce debt burden by:

$$\frac{\bar{B}}{P_S} - \frac{\underline{D}}{1 + r_S}$$

- Natural rate of interest is endogenously increasing in P^S:

$$1 + r_S = \frac{\frac{1}{2}Y + \underline{D}}{\beta\frac{1}{2}Y + \beta\frac{\bar{B}}{P_S}}$$

- Get *Fisherian debt-deflation spiral*:
  - Initial deleveraging pushes down prices.
  - Which increases real debt burdens if debt is nominal, which leads to more deleveraging.

Fisherian Debt Deflation Spiral

- Deflation is a double whammy:
  1. Real interest rate when $i_t = 0$ is $r_t = -E_t\{\pi_{t+1}\}$.
     - If $r_t^n < r_t$ deflation increases gap between r_t and r_t^n
     - Thereby contracting output by IS curve.
  2. Deflation increases nominal debt burdens
     - This leads to more deleveraging, pushing r_t^n down further.
     - Thereby contracting output by IS curve.
- Together, lead to devastating "black hole."

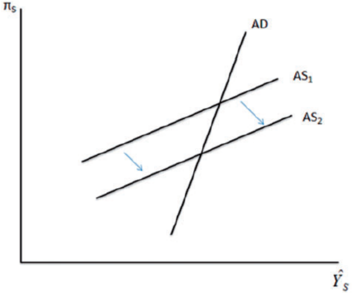
Fisherian Debt Deflation in a Production Economy

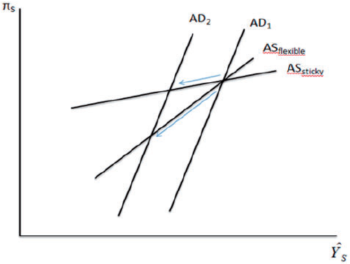
- Eggertsson and Krugman embed their model in a NK model with production.
  - Do not have time to cover, but sketch some surprising results.
- Key feature:
  - Combine Taylor rule with ZLB and IS curve into an aggregate demand curve that relates x_t to π_t.
    - Together with NKPC, which is aggregate supply curve relating π_t to X_t, determines equilibrium.
  - However, because of deflation causes big contractions in aggregate demand with sticky prices (and because borrowers have MPC of one) the AD curve is *upward sloping*.
- This leads to some truly topsy-turvy behavior!

The Liquidity Trap Paradoxes

1. Paradox of Thrift: If try to save more, savings falls.
2. Paradox of Toil: If try to work more, employment falls (left).
3. Paradox of Flexibility: Contraction worse with more price flex (right).

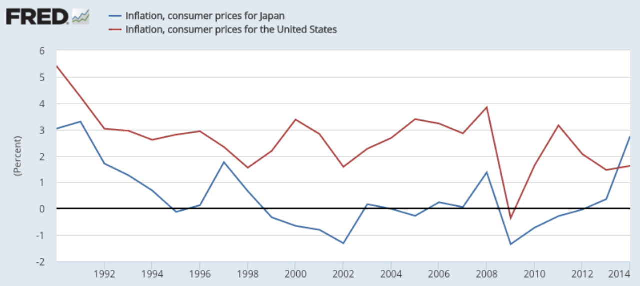
- All work by causing deflation, which contracts agg demand.





How Relevant Is Debt Deflation?

- Fisher (1933) argues that it was crucial in Great Depression.
- But in Great Recession in US and last 20 years in Japan, little to no deflation.
  - Underscores that we do not understand inflation fully.
  - "Turbocharger" of liquidity trap is absent.



Should Policy Work to Prevent a Liquidity Trap?

Harvard Professor and former Fed Governor Jeremy Stein:

> *"I am going to try to make the case that, all else being equal, monetary policy should be less accommodative – by which I mean that it should be willing to tolerate a larger forecast shortfall of the path of the unemployment rate from its full-employment level – when estimates of risk premiums in the bond market are abnormally low .... The informal intuition I have in mind is that there is a cost associated with pushing risk premiums too low, because doing so increases the likelihood that they may revert back in a way that hinders the Federal Reserve's ability to achieve its mandated objectives."*

Should Policy Work to Prevent a Liquidity Trap?

- Lots of attention recently to *macroprudential policy*.
  - Policies that take *ex-ante* preventative steps for benefit of macroeconomy to avert another Great Recession.
  - If problem that caused Liquidity Trap was high debt, should policy limit debt accumulation directly?
  - Should monetary policy adjust i_t to prevent debt buildups?
- But what is the justification for such policies?
  - Need an externality. What is it?
- Korinek and Simsek (2016):
  1. Extend Eggertsson-Krugman to simple production economy.
  2. Add "leveraging pre-period" before E-K short run where agents choose debt knowing that debt limit will bind next period.

Korinek and Simsek: Aggregate Demand Externality

- When households take on debt, they do not take into account that their decisions that affect aggregate demand, which affects aggregate output and other households' income.
    - Everyone knows debt limit will tighten.
    - But impatient borrowers will still borrow a lot and economy falls into liquidity trap that is not offset by *ex post* policy.
    - Households do not internalize effect of their debt on aggregate debt level that triggers liquidity trap, but planner does.
    - Equilibrium is constrained inefficient.
- GE channel linking debt to income creates *aggregate demand externality*.
    - Justifies regulating debt *ex ante*.
    - Monetary policy is *not* an effective tool.

Korinek and Simsek: Basic Setup

- Eggertsson-Krugman setup:
  - Two types of households $h \in \{b, l\}$ with $\beta^b \leq \beta^l < 1$.
  - Population of mass one, with half of each type.
  - Outstanding debt d_t^h, initial debt d_0^h.
  - At each date interest rate r_{t+1} and choose debt level d_{t+1}^h.
  - ZLB: $i_t \geq 0$.
- First new ingredient: Pre-period with no debt limit.
  - Debt limit $d_{t+1}^h \leq \phi$ binds for all $t \geq 1$.
  - Period 0 has no constraint, to generate potential leveraging.

Korinek and Simsek: Households Setup

- New ingredient 2: Simple production economy.
- Choose labor n_t^h to maximize utility $u\left(\tilde{c}_t^h - v\left(n_t^h\right)\right)$ so that labor supply solves static problem:

$$e_t = \left(\max_{n_t^h} w_t n_t - v\left(n_t^h\right)\right) + PR_t - T_t$$

  - No wealth effects is key, as both b and l choose same n_t^h.
- Defining net consumption as $c_t^h = \tilde{c}_t^h - v\left(n_t\right)$, household consumption and saving problem is:

$$\max_{\left\{c_t^h, d_{t+1}^h\right\}} \sum_{t=0}^{\infty} \left(\beta^h\right)^t u\left(c_t^h\right) \text{ s.t.}$$

$$c_t^h = e_t - d_t^h + \frac{d_{t+1}^h}{1 + r_{t+1}} \;\forall\; t \text{ and } d_{t+1}^h \leq \phi \;\forall\; t \geq 1$$

Korinek and Simsek: Production Economy Setup

- Production
  - Final goods produced Dixit-Stiglitz from intermediates.
  - Intermediates produced one-to-one with labor: $y_t = n_t$.
  - Labor subsidy so that monopolist distortion is undone.
  - Entirely fixed prices (for simplicity / lack of deflation) $\Rightarrow$ equilibrium is demand-determined.
- Demand for final good depends on monetary policy:

$$y_t = \frac{\tilde{c}_t^b + \tilde{c}_t^l}{2}$$

- Assume central bank sets:

$$i_t = r_{t+1} = \max\left(0, r_{t+1}^*\right)$$

where r_{t+1}^* is interest rate in frictionless equilibrium (e^*, y^*).

- Given $y_t = n_t$ and preferences, in frictionless equilibrium:

$$e^* = \max_n n_t - v\left(n_t\right) \text{ and } n^* = \arg\max_{n_t} n_t - v\left(n_t\right)$$

Korinek and Simsek: Equilibrium

- In equilibrium:
  1. Households solve labor supply and consumption problems
  2. Production side accommodates demand at fixed prices
  3. Central bank sets $i_t = r_{t+1}$ according to monetary rule, and markets clear.
- Central bank interest rate rule implies:
  1. If $r_{t+1} > 0$, $e_t = e^*$ and replicates E-K endowment economy.
  2. If $r_{t+1} = 0$, $e_t = \frac{c_t^b + c_t^l}{2} \leq e^*$ and *endowments shrink*.
- Consider cases where ZLB binds at date 1 but not date 0 and debt constraint binds so $d_{t+1} = \phi \; \forall t \geq 1$.
  - Also let $d_t = d_t^b = -d_t^l$.

Korinek and Simsek: Solution Strategy

- Solve model backwards:

1. Period 2 and beyond steady state (E-K long run).
   - Solve r_{t+1}, c_t^b, and c_t^l in equilibrium.
2. Period 1: Deleveraging (E-K short run).
   - Solve r_2 and e_1, which depend on d_1.
3. Period 0: Leveraging.
   - Solve for d_1.

Korinek and Simsek: Period 2 Onward

- Solve for r_{t+1}, c_t^b, and c_t^l.
- Same as E-K long run:

$$r_{t+1} = \frac{1-\beta^l}{\beta^l} > 0$$

- Since $r_{t+1} > 0$, at frictionless outcome:

$$\begin{aligned} c_t^b &= e^* - \phi\left(1-\beta^l\right) \\ c_t^l &= e^* + \phi\left(1-\beta^l\right) \end{aligned}$$

Korinek and Simsek: Period 1 Solution for e_1

- Debt constraint binds, c_t^b decreasing in d_1 and increasing in ϕ:

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

- Lenders on Euler: $\frac{u'\left(c_1^l\right)}{\beta^l u'\left(c_2^l\right)} = 1 + r_2$.
- Lower bound on real interest rate sets upper bound on lenders' consumption in equilibrium of $\bar{c}_1^l$ implicitly defined by:

$$u'\left(\bar{c}_1^l\right) = \beta^l u'\left(e^* + \phi\left(1 - \beta^l\right)\right)$$

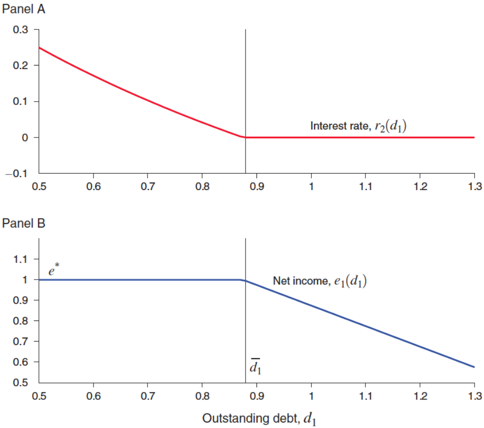
- Two cases:
  1. If $d_1 < \phi + \bar{c}_1^l - e^*$, $r_2 > 0$ and $e_1 = e^*$
  2. If $d_1 > \phi + \bar{c}_1^l - e^* \equiv \bar{d}_1$, liquidity trap with

$$e_1 = \frac{c_1^b + c_1^l}{2} = \frac{e_1 - d_1 + \phi + \bar{c}_1^l}{2} = \bar{c}_1^l + \phi - d_1 < e^*$$

Korinek and Simsek: Period 1: High Debt Reduces Output

- In liquidity trap, one person's income is other's spending:

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



Korinek and Simsek: Period 0 Solution for d_1

- Consider cases where $e_0 = e^*$.
- No debt constraints so both Eulers hold:

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

  which determine d_1 and r_1.
- Proposition: If borrowers are sufficiently impatient or indebted at date 0, private agents choose $d_1 > \bar{d}_1$ in equilibrium, triggering a liquidity trap.
  - Willing to stomach consumption drop in period 1 to consume more in period 0.

Korinek and Simsek: Externalities

- Let $V^h\left(d_1^h; d_1\right)$ denote utility of h conditional on individual debt level d_1^h and aggregate debt level d_1:

$$V^b\left(d_1^b, d_1\right) = u\left(e_1\left(d_1\right) - d_1^b + \frac{\phi}{1 + r_2\left(d_1\right)}\right) + \sum_{t=2}^{\infty}\left(\beta^b\right)^t u\left(c_t^b\right)$$

$$V^l\left(d_1^l, d_1\right) = u\left(e_1\left(d_1\right) - d_1^l - \frac{\phi}{1 + r_2\left(d_1\right)}\right) + \sum_{t=2}^{\infty}\left(\beta^l\right)^t u\left(c_t^l\right)$$

- In equilibrium $d_1^b = -d_1^l = d_1$, but *agents do not internalize*.
- Two externalities:
  1. If $\phi < d_1 \leq \bar{d}_1$ then $e_1 = e^*$, $r_2\left(d_1\right) > 0$, and externality through r_2.
  2. If $d_1 \geq \bar{d}_1$ then $r_2 = 0$, $e_1\left(d_1\right) < e^*$ and externality through e_1.

Korinek and Simsek: Pecuniary Externality

$$V^b\left(d_1^b, d_1\right) = u\left(e_1\left(d_1\right) - d_1^b + \frac{\phi}{1+r_2\left(d_1\right)}\right) + \sum_{t=2}^{\infty}\left(\beta^b\right)^t u\left(c_t^b\right)$$

$$V^l\left(d_1^l, d_1\right) = u\left(e_1\left(d_1\right) - d_1^l - \frac{\phi}{1+r_2\left(d_1\right)}\right) + \sum_{t=2}^{\infty}\left(\beta^l\right)^t u\left(c_t^l\right)$$

- In first case, $d_1 \in [\phi, \bar{d}_1)$, $e\left(d_1\right) = e^*$, $r_2 > 0$, and:

$$\frac{\partial V^h}{\partial d_1} = \begin{cases} -\eta u'\left(c_1^h\right) < 0 & \text{if } h = l \\ \eta u'\left(c_1^h\right) > 0 & \text{if } h = b \end{cases} \quad \text{where } \eta \in (0,1)$$

  - Higher debt level $\Rightarrow$ lower $r_2 \Rightarrow$ redistribution from l to b.
- Known as a *pecuniary externality* (works through prices,)
  - Common in many fields of economics.
  - Here, date 0 equilibrium is constrained Pareto efficient because markets between date 0 and 1 are complete.

Korinek and Simsek: Aggregate Demand Externality

$$V^b\left(d_1^b, d_1\right) = u\left(e_1\left(d_1\right) - d_1^b + \frac{\phi}{1 + r_2\left(d_1\right)}\right) + \sum_{t=2}^{\infty}\left(\beta^b\right)^t u\left(c_t^b\right)$$

$$V^l\left(d_1^l, d_1\right) = u\left(e_1\left(d_1\right) - d_1^l - \frac{\phi}{1 + r_2\left(d_1\right)}\right) + \sum_{t=2}^{\infty}\left(\beta^l\right)^t u\left(c_t^l\right)$$

- In second case, $d_1 \geq \bar{d}_1$, $r_2 = 0$, and for both b and l,

$$\frac{\partial V^h}{\partial d_1} = \frac{de_1}{dd_1} u'\left(c_1^h\right) = -u'\left(c_1^h\right) < 0$$

  - *Aggregate demand externality* in a liquidity trap.
  - Occurs because net income is decreasing in debt.

Korinek and Simsek: Planner Problem

- Consider a constrained planner who at date 0 can choose d_1 but not interfere thereafter and must set $d_1 \geq \phi$.
- Given Pareto weights $\gamma^h > 0$, planner solves:

$$\max_{\left(\left(c_0^h, n_0^h\right)_h, d_1 \geq \phi\right)} \sum_h \gamma^h \left[u\left(c_0^h\right) + \beta^h V^h\left(d_1^h, d_1\right)\right] \text{ s.t.}$$

$$d_1 = d_1^b = -d_1^l \text{ and } \sum_h c_0^h = \sum_h e_0^h$$

- Proposition: Solution is constrained efficient if $e_0 = e^*$ and one of the following holds:
  1. $d_1 \leq \bar{d}_1$ and $\frac{\beta^l u'\left(c_1^l\right)}{u'\left(c_0^l\right)} = \frac{\beta^b u'\left(c_1^b\right)}{u'\left(c_0^b\right)} \Rightarrow$ no inefficiencies below $\bar{d}_1$.
  2. $d_1 = \bar{d}_1$ and $\frac{\beta^l u'\left(c_1^l\right)}{u'\left(c_0^l\right)} > \frac{\beta^b u'\left(c_1^b\right)}{u'\left(c_0^b\right)} \Rightarrow$ never allow $d_1 > \bar{d}_1$.

Korinek and Simsek: Optimal Macroprudential Policy

- $d_1 > \bar{d}_1$ is Pareto dominated by $d_1 = \bar{d}_1$.
  - Aggregate demand externality generates first order losses.
  - Distorting Euler only creates second order losses:

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

  - So Pareto efficient to eliminate aggregate demand externality.
- Constrained optimum can be implemented in one of two ways:
  1. Unconstrained optimum with debt constraint $d_1 \leq \bar{d}_1$.
     - Agg demand externalities justify macroprudential policy.
  2. Unconstrained optimum with tax and insurance scheme.

Korinek and Simsek: Monetary Policy

- Why not just use monetary policy and set $r_1 > r_1^*$ at date zero?
  - Suppose does this and follows optimal policy rule thereafter.
  - This generates policy-induced recession with $e_0 < e^*$.
- With log utility,

$$d_1^b = \frac{1}{1+\beta^b}\left(e_1 - \beta^b (1+r_1)(e_0 - d_0)\right)$$
$$d_1^l = \frac{1}{1+\beta^l}\left(e_1 - \beta^l (1+r_1)(e_0 + d_0)\right)$$

- $\uparrow r_1 \Rightarrow \downarrow d_1^b$ holding e_0 and d_0 constant (sub effect).
- But two income effects go in opposite direction:
  1. $\uparrow r_1 \Rightarrow \downarrow e_1 \Rightarrow \uparrow d_1^b$.
  2. If $d_0 > 0$, $\uparrow r_1$ redistributes from b to $l \Rightarrow \uparrow d_1^b$.
- Simsek and Korinek show income effects can dominate, leading d_1^b to *rise* when increase r_1!

Korinek and Simsek: Monetary Policy

- Even if increase in r_1 reduces d_1^b, not appropriate instrument.
- If equilibrium has liquidity trap, planner wants:

$$d_1 = \bar{d}_1 \text{ and } \frac{\beta^l u'\left(c_1^l\right)}{u'\left(c_0^l\right)} > \frac{\beta^b u'\left(c_1^b\right)}{u'\left(c_0^b\right)}$$

  - Discounted MU of lenders rising more than borrowers.
  - So borrowers are not borrowing "too much" and cutting their consumption "too much" in liquidity trap, which is not issue for lenders whose consumption cannot rise enough due to ZLB.
- But monetary policy sets:

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

  - Influences both marginal utility profiles *equally*.
  - Cannot implement constrained efficient outcome.

Korinek and Simsek: Summary

- Aggregate demand externalities justify macroprudential policy.
  - Limit accumulation of debt.
  - Intuition:
    - When take on debt, internalize that may have to cut back on own consumption if debt constraints bind.
    - But do not internalize that this will reduce aggregate demand in a liquidity trap, reducing income for others.
  - Farhi and Werning (2016) show aggregate demand externality is present in broad class of models with nominal rigidity.
- Optimal combined policy:
  - Macroprudential policy addresses agg demand externality.
  - Monetary policy then achieves flex equilibrium (set r_1^*).
- Other types of macroprudential policies and monetary policy's response to credit markets are hot topics. This paper only provides one justification that focuses on liquidity trap.